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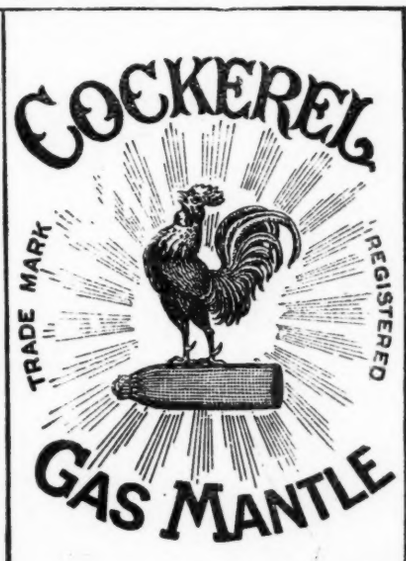

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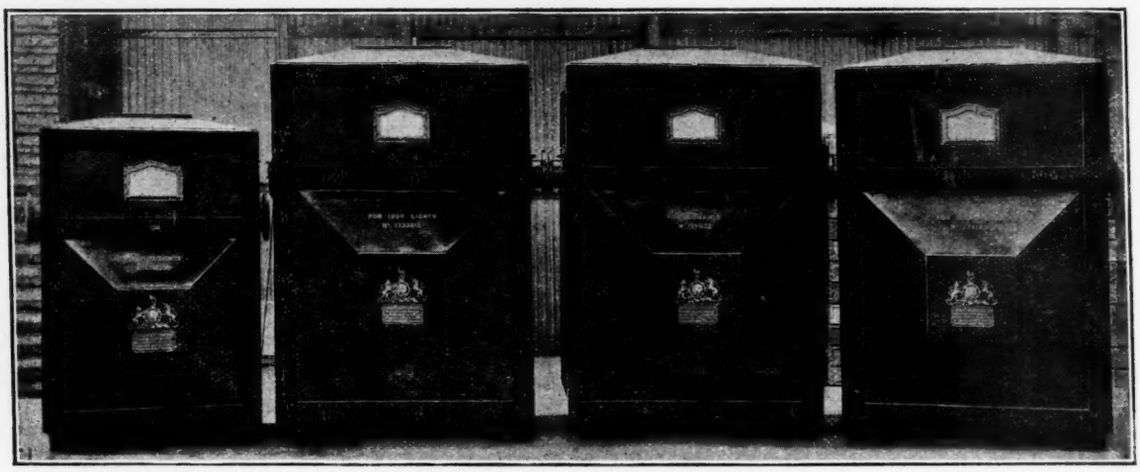

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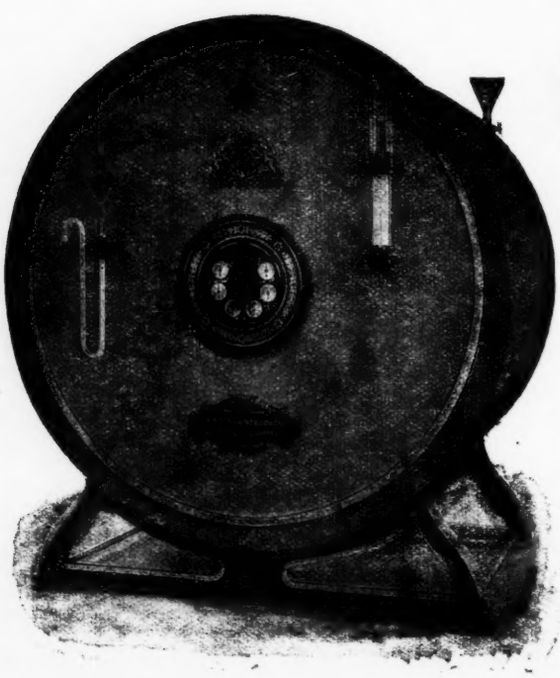

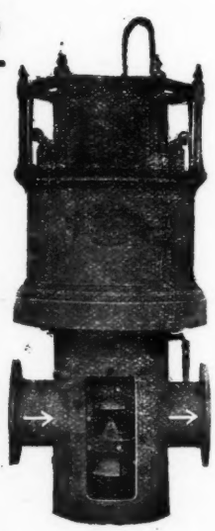

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VOL. CXLIV., No. 2896.] TUESDAY, NOVEMBER 12, 1918. [70TH YEAR.

THE ARMISTICE AND PEACE.

As we are preparing this issue for press, maroons are being fired in London, church bells are ringing, whistles are being blown from the factories, the people in the streets are cheering, faces are wreathed in smiles, down some tears are coursing over sad memories, and work is largely suspended. The great news has passed through the Metropolis like wild fire. The armistice has been signed by Germany, on the Allies' justly rigorous terms. The meaning for the whole world that there is in the short announcement is too much to comprehend all at once, coming as it does in natural sequence upon the dramatic events of the past few days, with their prelude of glorious achievement by the Allied arms. It means among much else the end of the hideous road that the world has been forced to travel through the arrogance and ambitions of those who until lately dominated Germany and Austria and certain vassal nations. It means the end of the great destruction of human life and property through war; it means the end of the cruelty and infamy which will brand Germany throughout the ages, and has made it a nation despised among nations. It means that Germany has learned the viciousness of the doctrine of might over right; and it is to-day a discredited and broken nation, undergoing an internal upheaval which has strange contrast with the boastfulness with which it entered the war over four-and-a-quarter years ago confident of its power to succeed, if not by fair by the most diabolical means that human ingenuity could devise. The day of reckoning has now come. The "War Lord" has fled; Germany is struggling painfully with the terrible havoc that he and his guilty henchmen have created for it. But the brief message announcing the signing of the armistice means above all things the Dawn of Peace. The curtain will rise and fall on other great scenes in these historic days, which will in their combination free the world from a beforetime ever-menacing incubus. From these scenes the world will pass to a new life, and with it the gas industry. But enough. We will not talk of material things in this paragraph when gladness and sad memories are intermingled in our hearts; when victory complete and secure is that of the Allies. The thing for the moment is to hail with the deepest thanksgiving the first steps to what it is profoundly hoped will be a lasting peace. In this hour of victory, too, we do not forget those brave and gallant ones who have lost their lives or have suffered much, or have shouldered responsibilities of unprecedented gravity, in winning for the Allies victory, and for the whole world Peace, for which we humbly and devoutly thank the highest of all powers.

The Reconstitution of the National Gas Council: A Momentous Meeting.

We are now at liberty to publish the draft Constitution and Rules for the reconstitution of the National Gas Council; and generous extracts will be found in other columns. But the general sketch which appeared in the "Journal" for Oct. 8 will have put the gas industry in possession of the salient features; and therefore the examination of what is now published will be made more with the view to glean supplementary information than to make any incipient acquaintance with the scheme. There will be gratification that the existing National Gas Council have decided to submit the plans for this constructive and highly essential piece of work to a meeting of the whole gas industry to be held in the Small Queen's Hall, Langham Place, W., on Thursday, the 28th inst., at 2.30. It is hoped that members of Boards of Directors and of Gas Committees of local authorities will be there in goodly number from all parts of the United Kingdom. In our opinion, the decision at this meeting will be a momentous one for the gas industry; for this is the first time in the history of the industry that any real endeavour has been made to organize the gas undertakings of the United Kingdom. The times and their conditions—the internal and the external circumstances of the industry, the defensive, offensive, and promoting work that has to be done—make imperative the organization of the undertakings, and the consolidation of their power. This must be done, and done now. Otherwise the opportunity will be lost, and the interests of the industry will suffer, and in a manner that will be a matter for everlasting regret. With before us the results of a survey as to what is likely to face the industry, we cannot write too confidently, too seriously, or too emphatically upon this matter. All little differences must be sunk; the interests of the industry must ride supreme. A united front must be shown; a concentration of authority and power wielded. This will be conferred upon the new body by the steps taken to make it universally representative of the gas undertakings. It will be found from the Constitution and Rules that in every possible way all matters are comprehended which will give the Council strength, which will safeguard, and which will remove from it the organic weakness from which its predecessor suffered. Therefore at the forthcoming meeting we look for hearty acceptance, and a departure from the meeting of all present unanimously resolved to give the industry a self-supporting organization representative of the sum of the strength and influence of the gas undertakings.

Organizing the Gas Undertakings.

It seems clear there is a little confusion in some minds as to what is one of the chief intentions of the reconstitution of the National Gas Council. We have the confusion reflected in a short article in another column, written by "Evening Observer." The time of day at which his observations have been made may account for the haziness that envelops his arguments. Not that we disagree with him in his ultimate design; for it is to the goal of complete organization that we have been working for years, with before us an opposition of considerable power. Nevertheless excellent progress has been made. The difference between us for the moment is that for our own part we see in the present proposal a means to our end; the "Evening Observer," in the gloom of observation, can only discern division. He would therefore jump at once into a scheme of complete organization for the industry—and more likely than not fail, because the work had not been done which the present scheme is destined to effect. Our present contributor submits that "the anomaly of attempting to form a perfect, united, and "fully representative body to act for the gas industry, with-"out including in it the vitally essential manufacturer, "must have been apparent to everyone." This is where the confusion comes in. What is being attempted is something that has never been attempted before, and that is to first create "a perfect, united, and fully representative body"—not for the gas industry in its entirety, but for the gas-supply undertakings.

That is a point which should be kept clearly and steadily

in mind; and if it is not obscured by other issues, it will be appreciated that there is something politic in ensuring that nothing exists to obstruct the progress of a scheme to bring about a condition that is absolutely essential to the maximum of completeness in the organization of the industry. The precedent condition is the thorough organization of the gas undertakings. And is it not obvious that, if the gas undertakings as a whole desire that the Society of British Gas Industries should be included at this stage before the undertakings themselves are fully organized, they themselves have the power to effect an amendment when they meet on the 28th inst. to finally ratify and adopt the scheme? Anyone can then raise the matter as a direct issue. But whether or not it would be prudent is another matter, because at the moment the view of those with their fingers upon the pulse of the movement is that nothing should be done that will project into it an obstacle to the perfect organization of gas undertakings. The Society of British Gas Industries are not being ignored, as will be seen by the review in other columns to-day of the Constitution and Rules of the reformed National Gas Council. Besides, the manufacturers are at present organized; the gas undertakings are not. The engineers are; gas companies are partly. But there is not a single organization representative completely of gas undertakings and their entire interests. The Society can afford to "sit tight" while the gas undertakings are being brought into a united and consolidated state; and then there must come—the promise has been made—the question of the welding of all the organizations of the industry in a manner in which there can be collective voice and action, without individual functions being disturbed. As we said last week, the Society must and will be there. The members are vitally necessary to any complete organization for the gas industry. Especially at this juncture (we repeat from what was said last week) there must be the closest co-operation between the members of the Society and gas suppliers in the matter of producing the plant for the making of the gas of the future and the properly designed and fitted appliances which will be required to secure from the gas the very highest efficiency. Co-operation between the two branches of the industry was never more essential; but this co-operation will not be assisted by such sarcasm as is incorporated in the exclamatory note "How gracious!" in our correspondent's article. The members of the Society of British Gas Industries are not the fools to indulge in any such mad caprice as "cutting off their noses to spite their faces." They, too, are wise enough to recognize that, as gas undertakings constitute the whole foundation and the major part of the superstructure of the gas industry, it is only right that leading place and part should be theirs. Yet at the moment gas undertakings are not organized, which is the greatest of all anomalies having relation to this question.

Then what has to be kept in mind is that a very real endeavour is now being made to bring about a thorough organization of the gas undertakings; and the object is one that is worth a little temporary sacrifice, and the repression of the ardour of those who think that the taking of a short cut will produce complete organization in the industry. In this instance, procedure which may necessitate going a little longer round may in the result produce the more complete structure, in which unity and co-operation will govern in the interests of an industry which so pressingly needs all the power it can command for the defence, the maintenance, and the progress of its interests.

Settle's "Downward" Steaming Process for Intermittent Verticals.

As this title is written after reading a "Communicated "Article" printed in other columns, the mind travels back a considerable number of years to the Exeter Gas-Works. The scene is vividly reconstructed. There is a setting containing a vertical retort with a curved end-piece for the discharge periodically and by gravity of part of the spent coke. The plunger is heard at work scattering, with mechanical regularity, a few pounds of coal at a time on the partly carbonized charge. Again in mind we watch the bounds of the hands of the large circular meter, which told of a fresh supplement having been made to the charge, and of a fresh rush of gas passing off. We see the thoroughly carbonized material that was evacuated; and it was good gas that was subsequently tested, with high makes per ton. This was all before the Dessau and other types of intermittent vertical retorts came along; all before continuous vertical retorts arrived upon the scene. The pioneer work of Thomas Settle never, in our opinion, had proper recognition, though he opened the eyes of the gas industry very widely indeed to immense possibilities.

Mr. Settle's work proceeds; and he is again to-day in the van of carbonizing progress with a process (patented in conjunction with Messrs. Goodall, Clayton, & Co., Ltd.) for the downward steaming of intermittent vertical retorts, and on which process working trials with a complete gas-works plant at Truro confer excellent testimony as to results. The process, the trials, and the results are the subject of an article by an independent investigator, who was kindly given all the necessary facilities by the Directors of the Company and Mr. S. J. Ingram, their Engineer. The "downward" steaming process, as anyone will see who studies the article and illustrations, is not nominally fully descriptive. It is true the steam (supplied at 30 lbs. pressure, and superheated to 300° Fahr.) takes a downward direction through the incandescent charge; but the issue of the water gas at the foot of the retort is only part of a cycle. The water gas hot as produced passes at once to the bottom of a freshly charged neighbouring retort; and, during the period of three hours which corresponds to the three hours that water-gas making is proceeding in the neighbour, it travels upwards through the charge, sweeping the rich gases out along with it, and protecting them against decomposition. The steaming is therefore downward; but the active work of the resultant blue water gas is upwards. It is a fascinating process. The steam in its descent and in its conversion sweeps the residual gases from the coke; in the freshly charged retort the diffusion of the blue water gas creates what Prof. Cobb would describe as a new atmosphere, hastens the evolved gases from the fresh charge, protects them, and at the same time the water gas is itself carburetted.

However, the article describes the new process and the work in such succinct form that we will here only mention the salient features of the results. The objective in the trials was to produce 500 B.Th.U. gas; and it was found possible to keep within the limits of ± 10 B.Th.U., and to produce in gaseous form close upon 10 million B.Th.U. per ton of coal, or 20,000 c.ft. of gas, with improved yields of tar oils and ammonia—12 gallons of tar oils and 30 p.ct. increase of ammonia. Formerly about 14,000 c.ft. of gas were made; so that on the basis of the trial results, there is a saving of upwards of 25 p.ct. of coal. There is working economy here. The recognized duty now of the gas engineer is to get from his coal the largest return possible in B.Th.U. and secondary products. It is also seen from the article that while the process is applicable to any large-scale installation of intermittent vertical retorts, it is also equally applicable to installations on small gas-works, the managers of which are not debarred from securing the equivalent of close upon 10 million B.Th.U. per ton of coal, or 20,000 c.ft. of gas. If this result can be secured at works having an annual output of about 50 millions, it can be done anywhere. It represents a remarkable flight in economy; and it demonstrates further that high makes through steaming are not confined to continuous vertical retorts.

We congratulate Mr. Settle upon the proof of the Truro working, and trust that it means for him a larger reward for practically a lifetime spent in the attempt to improve carbonizing practice.

Chemical Gas Engineering.

THE members of the Midland Association cannot complain of the quality of the papers presented to them at the recent meeting. It was excellent. The contribution by Mr. Harold E. Copp was noticed last week; and it marked an advance in the treatment of gas for the elimination of naphthalene. It could well have come as a supplement for illustrative purposes to the communication of Mr. W. A. Twine, the Chemical Superintendent of the Birmingham Gas-Works, on "Chemical Engineering in Modern Gas-Works," though Mr. Twine himself required no assistance in finding sufficient illustrations to demonstrate the necessity for a closer alliance between chemistry, physics, and engineering in the technical staffs of gas-works, and in the supreme head of these staffs. This has long been foreseen; but with the exception of some of the larger works, the facts and the necessities have been largely ignored. The best paying gas undertakings in the future will be those that are run from the beginning to the end of the processes with a chemical engineer at the helm. "I believe," said Mr. Twine, "that "the successful gas engineers in the future will be those

" who have made a study of, and have had experience in, " chemical engineering." There can be no doubt about it. In large gas-works, there is a considerable amount of technical devolution; but nevertheless the chief responsible technical official should be both an engineer and a chemist, if he is to be capable of exercising proper supervision and of planning wisely. Otherwise what becomes of his position as an engineer? He would show an utter incapacity for confidently translating into material structure all that is necessary from the chemical point of view, or his plans would always be subject to endorsement, and more probably than not to amendment, by the chemist. The whole of the processes of a gas-works to-day claim that the chief official must be as much a chemist as an engineer if he is going to carry on efficiently the works under his control. The small works are in a different position. They cannot afford the staff that the larger works can do; but notwithstanding, for conducting the smaller scale works if the utmost profit is to be made out of them, the qualifications of the manager must be of a higher order than those that ruled in the past. Otherwise there will be perpetual waste, which the gas industry cannot afford, and which cannot be tolerated. In short, there are going to be new standards of efficiency in gas-works, both large and small; and their achievement will depend greatly upon the efficiency of those who control. However, it is good to see that men of broader and deeper training are penetrating into the work of the industry; but the rate of their penetration is a melancholy one when compared with the boastfulness of the industry as to its progressiveness, the more modern part of which has been whipped-up by war requirement.

Mr. Twine says that the gas engineer will be compelled to recognize that the bye-products are of primary importance instead of holding the secondary position to which many engineers have allocated them. Really we are beginning to think that all the products are front rank ones now, and that there is such an interdependence among them technically as well as commercially that no undue favour or negligence should be shown to any one of them. Chemical engineering does not commence with the products which have hitherto been distinguished by the terms " residual " or " secondary," or the prefix " bye." It commences with the correct treatment of the coal itself, and then of the gas. We have learnt much during the war; and what we have been learning has been largely the product of not the engineer, but the chemist and the physicist. The engineer has made discovery that he can do certain things in certain ways; but it has been the chemist who has defined exactly what these ways should be. It is the chemist and the physicist who have told the engineer the why and the wherefore of things, who have ironed-out for him his difficulties, and who have kept his feet from stumbling in those pitfalls that gape open round about him, but which, where there is not the necessary knowledge, he is unable to avoid, except by sheer luck. The fully qualified " gas engineer " of the future will deserve a descriptive title of a more comprehensive character. " Gas chemical " engineer " is clumsy. " Chemical engineer " is too broad. Besides, it does not retain the distinctive term " gas," which describes the direction of specialization.

However, in the gas-works of the future, Mr. Twine would have no chemical waste. He would have everything possible brought as a contributor to the credit side of the account; and he shows that the field for this is great if technical qualification rules. We are glad to read his references to ammonia purification. For some time past we have been looking for the fruition of the work which Dr. Davidson some time ago showed was proceeding at Birmingham in connection with liquid purification, and which gave the promise of an economical and workable process for the removal by ammonia of carbonic acid and sulphuretted hydrogen, and for the subsequent treatment of the impurities and the ammonia, and the turning of them to profitable account. The war placed obstacles in the way of the rapid development of the system; but after what Mr. Twine says there is good reason to believe that the promise of a time ago will soon be fully redeemed. Over two years since Mr. Twine was invited by the High Explosives Department to suggest a method for obtaining pure ammonia from coke-oven liquors and ammoniacal gas liquor. A prior difficulty had been the separation of the sulphuretted hydrogen and the carbonic acid, and in the same operation the distilling-off of the ammonia gas to yield pure liquid ammonia of 25 to 30 p.ct. The result of the invitation was a plant being designed capable of eliminating the impurities, and at the same time yielding 30 p.ct. solution of ammonia. A similar plant is required in gas-works for the purification of gas by means of ammonia. We appear now to be on the verge of realization, with probable economies of heat and costs both in distilling-off the ammonia and in dealing with the carbonic acid and the sulphuretted hydrogen evolved from the eliminating vessel. Instead of dealing with the latter in the ordinary Claus kiln for the production of sulphur, Mr. Twine prefers to burn them to sulphur dioxide, and then convert into sulphuric acid in a tower plant, which occupies much less space than the sulphuric acid chamber process. There has been a lot of talk lately about the amount of sulphuric acid plant that has been brought into existence through the war, and its capacity for over-production after the war. We do not know that this is a matter which need trouble the chemical gas engineer. It is in the interests of his concern to get what he requires on the most economical of terms. We quite agree as to the likelihood of all large gas-works in the near future working-up their own sulphur to sulphuric acid, so obtaining a material free from arsenical impurities, saving no little trouble in working-up their salts, and keeping in their own coffers money now spent in railway carriage. The sulphuric acid makers may not like this; but it is a sensible thing to utilize what is on the spot if economy can be realized.

We are carried on by Mr. Twine into the manufacture of ammonium chloride, and later into the production of cyanogen compounds. But the real message of his paper is that nothing that can be profitably utilized should be lost; and this means for gas-works trained chemical engineers. No one capable of examining the present position and peering from it into the future, will be prepared to attempt to controvert the message.

Gas Consumers and Lower Calorific Power Gas.

THE fact that—within, of course, reasonable limits and in certain circumstances—gas of lower calorific power can be made to render as much service to the consumer as formerly supplied higher calorific power gas, is something that is still regarded as a phenomenon by numbers of gas engineers, and is the subject of marked disbelief. But others, applying theoretical consideration and practical experience and trial, know that it is a fact, although not so if extremes are resorted to. The point was made several times in the discussion of the Gas Investigation Committee's report at the meeting of the Institution of Gas Engineers; and it was heard again, and its correctness received further attestation, at the subsequent meeting of the Manchester Institution—evidence being forthcoming from more than one source that, with the lowering of calorific value to 450 B.Th.U. gross (a value of 350 B.Th.U. is also spoken of), consumers' meter registrations are not showing increases in volume, or not in volume proportionate to the reduction of the calorific power per cubic foot. A paragraph in the " JOURNAL " last week [p. 313] shows that the point has attracted notice and investigation in America. The reporters on the subject are Messrs. Nash, Powell, and Vittinghoff; and they find that, while there is some relation between gas quality and gas consumption, the relation is not one of simple proportion. In Massachusetts, the gas has an average calorific power some 40 B.Th.U. less than formerly; but the examination of the consumers' meters of a number of the larger companies does not disclose any increase whatever in consumption. This is a large-scale piece of testimony. There are two explanations regarding the apparent paradox. First, that the higher standard gas contains a larger percentage of hydrocarbon vapours which are easily condensed by exposure to cold; and therefore, though the calorific quality of the gas at the works may be high, it is not necessarily the calorific quality that reaches consumers. The second point is that consumers' appliances must be adjusted to deal with the lowest quality of gas that reaches them; and thus they are in the condition to deal better with the lower than the higher quality gas. In appliances where there are no means of adjustment, a better result is obtained with the lower quality of gas with its high proportion of fixed gaseous constituents; and this is an advantage to supplement the benefit realized from the better admixture of the gas and air than is secured by gas of higher though not such useful quality. All the evidence points to the fact that it is much better to keep low the proportion of easily condensable hydrocarbon vapours, and the fixed combustible constituents high. Then the consumers will derive good value and

faction. When tests are being made at a gas-works of different grade gases, the investigators are not altogether reproducing the conditions that exist in the houses of the consumers after the gas richer in condensable hydrocarbons has travelled through pipes of various sizes, and subject to friction in them and in the gas-meter; so that such tests require some amount of qualification. A gas is required in all parts of a district that is of as constant quality as possible—no matter the prevailing temperature; and this gas is not one containing a high percentage of easily condensable hydrocarbon vapours.

Hand-Stoking by Women.

In the article that appeared in the "JOURNAL" for Oct. 1, on "Vauxhall Sends Forth Women Stokers," mention was made of the fact that a dozen women stokers for hand work had been transferred from the Vauxhall station of the South Metropolitan Gas Company to a Surrey gas-works, and were carrying on the operations quite successfully. This piece of enterprise and demonstration is due to the Woking Gas Company and their Engineer and Manager (Mr. W. H. Ely). Generally speaking, gas engineers have been averse to women taking on retort scoop charging and hand discharging. But there are evidently women who believe more in their own capacity for this class of work than do gas engineers. And at Woking the women have again proved themselves right. There has been a desire to put the matter to the test, because previously objection was based solely upon opinions unsupported by experience. However, Mr. Ely came forward and volunteered to co-operate in a trial; and it has succeeded admirably. Now to-day he is regularly employing twelve women in his retort-house (four on each shift); and they are doing all the work the same as the women in the machine-operated houses at Vauxhall—men being reserved for the furnace work. Though the military situation is all that we could desire, nevertheless whatever happens those in the best position to judge say there is bound to be a tremendous shortage of labour at gas-works during the immediate months.

Rendering Acid Neutral in Sulphate of Ammonia.

The report of the Sulphate of Ammonia Association, published in the "JOURNAL" last week, together with some illuminating remarks by the Chairman (Mr. D. Milne Watson), shows that one of the things the Committee have prominently in mind is the need for a strong united front in view of the new commercial position that will, through an enlarged and keener competition, face the makers of sulphate soon after the war. One of the most effective members in a united front will be quality. An acid-free material, with a minimum percentage of moisture, will be of inestimable advantage in competition both at home and abroad; for such sulphate would mean an economy not only to manufacturers but to the country generally. There has been trouble enough as to the perishing of bags and damage to and loss of contents owing to the action of acid and moisture. Official recognition has been made of this by the allowance of 5s. per ton extra for sulphate containing less than 0·025 p.ct. of free acid. For some time past there have been methods under investigation for neutralizing the acid, and promising ones too, of which there was excellent testimony to hand. But there was not entire satisfaction on the part of those who investigated the matter on behalf of the Association, though it was obvious that, if manufacturers adopted some such process, it would be easy to standardize the make of sulphate, in which direction the South Metropolitan Gas Company have been successfully working for a long time. It will be seen that the report by the Committee of the Association (published in our columns last week) referred to the Adam process of neutralizing the acid, which process is now in operation at the works of the Gas Light and Coke Company. The testimony in the report leaves no room for doubt as to the efficiency of the process. "The salt produced," it is said, "is superior to any sulphate of ammonia previously placed on the market in Europe; and it is to be hoped that the great majority of makers in the country will be producing neutral sulphate by the time export on a large scale is again possible. The question of quality is, however, equally important as a means of retaining the home market." Mr. Adam's system of rendering sulphate neutral is by passing ammonia gas through it—the sulphate being placed on a grid, and the ammonia gas blown through it, or the sulphate may be continuously fed into an inclined rotating cylinder, in which it meets a stream of ammonia gas passing in the opposite direction. The process is patented.

Petroleum Prospects at Home.

We are not very much concerned as to the squabble in Parliament over the question of whether or not the Government have shown favouritism in appointing Messrs. Pearson and Son, Ltd., their Petroleum Development Managers, and shut out all other would-be explorers and borers for oil. The main thing is that Lord Cowdray's firm have spent some three-and-a-half years and a million sterling over the subject. All the knowledge they have accumulated they have placed freely at the disposal of the Government; so that they are making a great sacrifice. It would have been little less than madness for the Government not to have accepted the services of the firm with the accumulated experience. The point of the matter that interests us most is the likelihood of bringing subterranean derived oil into account as a national asset. Lord Cowdray, during a debate in the House of Lords last Wednesday, stated that, as the result of the careful study made for his firm by the finest oil experts in the world, they had found such indications of oil that they were surprised other geologists had not been on the search for it. At the same time, he warns the country that its oil resources must be much smaller than those of America. No one but a greenhorn would have anticipated otherwise. He also spoke of the American Government being disturbed because it was told that within twenty-seven years its oil wells will be exhausted. There is good reason in all this for as much as possible being done at home through coal carbonization, within the limits set by the demand for the other products, to supplement the home supplies of oils. In Committee in the Lords, on the Petroleum (Production) Bill, the Government have accepted an amendment to the effect that nothing in the Act shall prejudice or affect the rights of any person interested in the land in respect of petroleum gotten through or from land of which he is the owner.

Nitre Cake in the Production of Ammonium Sulphate.

In the Chemical Society's "Transactions," Mr. H. M. Dawson says that, when finely powdered Glauber's salt and ammonium sulphate are brought into intimate contact at the ordinary temperature, a pasty mass is obtained and the temperature of the mixture falls considerably. This is due to the formation of sodium ammonium sulphate. The lowest temperature at which this reaction occurs is — 16° C. Above 59·3° C., the double salt decomposes with the formation of the anhydrous simple salts. The composition of the saturated solutions which characterize the ternary system has been determined at temperatures between — 19·5° C. (the eutectic temperature) and 100° C. The solutions which are saturated simultaneously with respect to the double salt and sodium sulphate show a very pronounced minimum in the ammonium sulphate content and a maximum in the sodium sulphate content at 26·5° C., which is the temperature at which Glauber's salt is transformed into anhydrous sodium sulphate in presence of the double salt. Though the double salt may be crystallized out from the solutions containing the mixed sulphates at any temperature between — 16° C. and 59·3° C., if the ratio between the salts is suitably adjusted, yet the double salt is decomposed by water between — 16° and 20° C. with the separation of Glauber's salt, and between 41·5° and 59·3° C. with the separation of anhydrous sodium sulphate. In view of the fact that solutions saturated with respect to Glauber's salt and ammonium sulphate (or the double salt) at low temperatures contain a large excess of ammonium sulphate, it is possible to crystallize out a large proportion of sodium sulphate from a solution containing the two sulphates by cooling. If the mother liquor is subsequently evaporated at about 100° C., pure ammonium sulphate may be obtained, so long as the ratio of ammonium sulphate to sodium sulphate in the residual hot liquor does not fall below about 2·7. By repeating the cooling and evaporating processes, complete separation of the sodium and ammonium sulphates may be effected. By the use of this process it is possible to make use of nitre cake for the absorption of ammonia in the production of ammonium sulphate; Glauber's salt being obtained as a bye-product.

Temporary Increase of Charges Act.—The Local Government Board have granted Orders under the Statutory Undertakings (Temporary Increase of Charges) Act to the Ashburton Urban District Council, increasing the maximum price from 5s. 6d. to 6s. 8d. per 1000 c.ft.; to the Brigg Urban District Council, with an increase from 4s. to 6s. within the district, and from 5s. to 7s. 6d. outside; and to the Skegness Urban District Council, with an increase from 4s. 3d. to 6s. 4d. per 1000 c.ft. The Board have received an application for an Order from the Thornton Urban District Council.

NATIONAL GAS COUNCIL OF GREAT BRITAIN AND IRELAND.

Draft of the Proposed Amended Constitution and Rules.

IN the issue of the "JOURNAL" for Oct. 8, we gave a sketch of the scheme for the reconstruction of the National Gas Council; and now we have at hand the complete draft, which it is proposed to submit at a meeting of the gas industry convened for Thursday, the 28th inst., at 2.30, in the Queen's Hall, Langham Place, W.

Prefacing the constitution and rules is a statement explaining them, which we give *in extenso*.

The existing constitution and rules of the Council were drawn up to meet an urgent need for a body which could represent the claims of the gas industry in connection with abormal conditions arising out of the war. Its present membership includes: "(1) The Presidents, Vice-Presidents, and Council for the time being of the Institution of Gas Engineers; (2) the President, Vice-Presidents, and General Committee for the time being of the British Commercial Gas Association; (3) the President and Committee for the time being of the Gas Companies' Protection Association; (4) the President, Vice-Presidents, and Council for the time being of the Society of British Gas Industries," together with various members co-opted since the formation of the Council to give representation to the various District Institutions and Associations of Gas Engineers and Managers throughout the kingdom.

Since the Council's inception in November, 1916, occasions have frequently arisen when it has proved necessary to appeal to the whole of the gas undertakings in the kingdom before taking any definite action. Such a necessity would be better met by establishing the Council on a different basis, providing for direct representation thereon of every gas undertaking desirous of membership; and in order to effect this the new rules have been drafted.

The following notes on some of the revised rules may serve to make clear the objects sought to be attained in the drafting of them:

RULE III. (4) provides for the Council being in a position to subsidize any scientific investigations in the interests of the industry which it may be necessary for the Council, or for one or any of the associated bodies, to undertake in future, and for which the funds of the latter may be insufficient.

RULE III. (5). Under this new rule, the Society of British Gas Industries will be associated with the National Gas Council by the formation of a Joint Standing Committee consisting of equal numbers from both bodies, by which it is felt that common interests will be better and more suitably served than by the existing arrangements.

RULE III. (6). The Committee of Employers, the formation of which is one of the objects of the new Council, is to be a separate organization. Membership of the Council will not, therefore, necessarily entail membership of the Employers' Committee. Undertakings having representatives on the Council, but not on the Employers' Committee, will remain at liberty to adjust their own wages matters. Such an Employers' Committee would provide a means towards the formation of a Joint Standing Industrial Council for the gas industry.

RULE III. (8). It is eminently desirable that the Council should be self-supporting. Up to the present, it has relied upon the generosity of the associated bodies, whose funds are not more than sufficient for the carrying on of their own work.

RULE III. (9). The Council may have to take action with respect to legislative proposals affecting the industry as a whole—such as legislation determining the quality of gas to be supplied, the coal and coke questions, &c.—which would not be dealt with by any of the other associated bodies.

RULE IV. (2). The Institution of Gas Engineers, the British Commercial Gas Association, and the Gas Companies' Protection Association will be termed "associated" instead of "incorporated" bodies.

RULE IV. (3).—Members. This provides for the three associated bodies still electing a proportion of the members of the Council, as heretofore. The Society of British Gas Industries will continue to be associated through the Joint Standing Committee already referred to, and will be represented on the Council through the British Commercial Gas Association in measure as they contribute to the funds of that body.

RULE IV. (4). Provides for the co-option of distinguished men of science, &c., not directly connected with any section of the gas industry.

RULE IV. (5). Provides for the Council becoming directly representative of every gas undertaking desiring to join.

RULE VI. (1). A Central Executive Board will take the place of the existing Executive Committee and General Consultative Committee. It has been found from experience that these two Committees have often resulted in duplication of work. The provision for the election to the Central Executive Board of the Honorary Treasurer, the Trustees, and the Honorary Secretary or Secretaries, together with four members of each District Executive Board, is new. The existing Executive Committee found it necessary to co-opt the Honorary Treasurer and a representative from each District Institution or Association of Gas Engineers and Managers throughout the country.

RULE VI. (3). Each District Executive Board and each associated body will elect in the first place four members to the Central Executive Board. At the end of the first year, each of the bodies referred to will determine by lot the rotation in which their four members shall retire from the Central Executive Board; but each such member will be eligible for re-election. This provision makes continuity of office possible, but not compulsory.

RULE VI. (4). This gives power to the Central Executive Board to co-opt persons outside the membership of the Council for consideration of any special matters requiring the experience of technical or other experts.

RULE VI. (6). The quorum has been altered from five to seven (out of a total membership of the Central Executive Board numbering about 50).

RULE VI. (7). Words relating to finance have been added here, as the Council requires authority to receive such funds as are necessary for carrying on its work, which funds will vary according to the demands made upon the Council.

RULE VI. (8). The Central Executive Board will deal with all matters of legislation and all questions of national application (except matters connected with the separate Committee of Gas Employers). The District Executive Boards will deal with matters of local interest; all questions likely to affect other districts or the industry at large being referred to the Central Executive Board. In this way, both decentralization and co-ordination will be effected in what it is believed will prove to be a satisfactory manner.

RULE VII. (1). Nine districts have been enumerated in the draft rules; but working conditions may point to the necessity for re-grouping these—either before the rules are finally approved or afterwards, as provided for in Rule VII. (2).

RULE VII. (12). The expenses of District Boards will naturally vary according to the size and location of the district. It may be mentioned that a grant from the Central Executive Board might possibly be given to cover such costs as the travelling expenses of district members when attending meetings of the Central Executive Board.

RULE IX. (2). Provides for the appointment of a manager or managers, &c. The work has hitherto been carried on largely on a voluntary basis; but it is becoming necessary for it to be supervised by a manager giving his whole time.

RULE X. The investment clause has been considerably widened; and the new form which is commonly used in trust deeds is based on a clause drawn up by a well-known Chancery Counsel.

RULE XII. (2). At present cheques are signed by one member of the Executive Committee and one of the Honorary Secretaries. In future two members of the Central Executive Board will sign, together with one Honorary Secretary.

RULE XIII. (2). Only one of the two representatives of an undertaking may vote in a poll. The rule that a poll may be taken at the request of any five members present at a general meeting was made in order that no important decision may be taken at a meeting where there is possibly insufficient representation of some particular interest (owing to unavoidable absence of members). The total voting power of the whole industry under this rule would be 2269; and the voting power of the largest undertaking would only be 117. This rule, therefore, operates to the advantage of the smaller undertakings.

CONSTITUTION AND RULES.

We do not propose to print in full the constitution and rules; but the following are extracts and some indication as to their contents.

In Rule III. we have the objects of the Council.

OBJECTS.

(1) To promote or defend the interests of the gas industry of the United Kingdom.

(2) To purchase, take on lease, or otherwise acquire, and also to dispose of, any houses or lands of any tenure or any real or personal property, rights, or easements for the purposes of the Council.

(3) To maintain, repair, enlarge, or otherwise alter or improve, any buildings of the Council; and to build such new buildings as may be required for the purposes of the Council.

(4) To subsidize and, if necessary, carry on scientific investigation regarding matters connected with the manufacture, distribution, and utilization of gas or its bye-products.

(5) To form Joint Standing or other Committees with the Society of British Gas Industries, the Sulphate of Ammonia Association, or any other bodies connected with the gas industry for discussing and taking action upon matters of common interest.

(6) To form a separate Committee of Employers. The objects of such Committee shall be:

(*a*) To promote and further the interests of the members of the Committee as employers of labour.

(*b*) To secure mutual support and co-operation (i.) in dealing with all matters or questions affecting general and common interests in connection with rates of wages, employment of apprentices, hours of labour, overtime, limitation of work, piece-work, and similar matters; (ii.) to secure the equitable carrying out of agreements made with workpeople and combinations of workpeople; and (iii.) to secure a permanent improvement in the relations between the employers and the workpeople.

(*c*) To give to members of such Committee all such assistance (whether pecuniary, legal, or otherwise) as to the Committee shall appear proper or desirable.

(*d*) To make provision for dealing with differences between members of such Committee and their workpeople.

(*e*) To elect persons to represent the members of such Committee upon National and District Industrial Councils.

(*f*) To do all such other things as are, in the opinion of such Committee, incidental or conducive to the attainment of the above objects or any of them.

(7) To form such other Special Committees as may be necessary.

(8) To raise and administer funds for any purposes of the Council.

(9) To watch over, and take any steps which may seem desirable

with reference to, any legislative measures or proposals for legislative measures which may affect or tend to or be likely to affect the interests of the industry, and to give to members of the Council all such assistance as to the Central Executive Board shall appear desirable.

(10) To do all such other lawful things as may from time to time be incidental to, or conducive to, the attainment of the above objects or any of them.

CONSTITUTION.

In Rule IV. the constitution is explained. From this, it is seen that the Council shall consist of a President, Vice-Presidents, and ex-officio members, honorary members, and elected representative members. The President shall be selected for his eminence in the gas industry. The methods of election are set forth. The remaining sub-sections to the rule are:

(2) VICE-PRESIDENTS.—The Vice-Presidents shall comprise the Presidents for the time being of the Institution of Gas Engineers, the British Commercial Gas Association, and the Gas Companies' Protection Association (which Institution and Associations are in these rules referred to as the "Associated Bodies"), the President of the Society of British Gas Industries, and any other persons eminent in the gas industry whom the Central Executive Board may elect.

(3) EX-OFFICIO MEMBERS.—The ex-officio members shall be: (1) The Vice-Presidents and Council for the time being of the Institution of Gas Engineers; (2) the Vice-Presidents and General Committee for the time being of the British Commercial Gas Association; (3) the Committee for the time being of the Gas Companies' Protection Association.

(4) HONORARY MEMBERS.—Honorary members may be nominated by the Central Executive Board for their distinguished services to the industry, and, if approved, elected at the next following annual meeting of the Council.

(5) ELECTED REPRESENTATIVE MEMBERS.—Elected representative members shall be elected by the gas undertakings (municipal or company) of the United Kingdom and Ireland which subscribe to the funds of the Council in accordance with Rule XIV.; each such gas undertaking having the right to elect two representative members, one of whom may be a chairman, director, or member of gas committee, and the other shall be a manager, engineer, or secretary of the gas undertaking.

JOINT STANDING COMMITTEES.

It is provided by Rule V. that the Joint Standing or other Committees shall appoint their own Secretaries, and meet at such intervals as may be necessary.

CENTRAL EXECUTIVE BOARD.

In Rule VI. provision is made for a Central Executive Board; and sub-sections 1, 2, and 3 are as follows:

(1) The business of the Council shall be managed by a Central Executive Board consisting of the President, the Honorary Treasurer, the Trustees, and the Honorary Secretary (or Secretaries) of the Council, four members of each District Executive Board to be elected as provided in Rule VII. (4), and the members elected by the associated bodies as provided in sub-section (2).* [See foot note]

(2) Each associated body may, subject to the provisions of sub-section (3), elect four members to the Central Executive Board, each of whom must be a representative of a gas undertaking.

(3) The members of the Central Executive Board shall remain in office for one year; and at the end of that and of each succeeding year one member out of the four members elected by each District Executive Board or associated body shall retire, but shall be eligible for re-election. The order of retirement of the members first elected shall be determined by lot; and retirement thereafter shall be by rotation. Any member elected to fill a vacancy shall do so only for the unexpired period of his predecessor's term of office.

The succeeding sub-sections of the rule deal with the power of co-option, elections by the Central Executive Board, meeting, business, and appointment of committees for special purposes. Perhaps prominence might be given to sub-section 8, which says:

(8) The Central Executive Board shall advise and decide on any question which may be referred to it by any District Executive Board. The Central Executive Board alone shall deal with all matters of legislation and all national questions other than questions properly to be referred to the Committee of Gas Employers.

DISTRICTS.

In Rule VII. there is provision for the appointment of District Executive Boards. These districts will in the first instance be known as: England—(1) Eastern District, (2) Manchester District, (3) Midland District, (4) Northern District, (5) Southern District, (6) South-Western District, (7) Ireland, (8) Scotland, (9) Wales. There is also provision for, if necessary, the re-grouping of the districts, and for the management of each district by a District Executive Board. Sub-sections 4 and 5 read:

(4) Each District Executive Board shall (subject to the provisions of Rule VI. (3) appoint four representatives to act on the Central Executive Board; and in making such appointments each District Executive Board shall have regard to the relative municipal and company interests in the district. The names of those appointed shall be forwarded to the Council's Secretary not less than fourteen clear days before the date fixed for the annual meeting of the Council.

(5) Each District Executive Board shall have power to administer matters concerning the district represented by them, save that no action shall be taken which will involve matters of national interest or legislation or affect the position of any other district or the Council as a whole, or matters reserved from time to time for the administration of the Central Executive Board.

* NOTE.—The Drafting Sub-Committee propose to recommend to the Council an addition to Rule VI. (1) as follows: At an annual meeting the Council may, should they deem it desirable, elect a further member or members (not exceeding four) to the Central Executive Board.

By sub-section 6 each District Executive Board will elect at an annual meeting a Management Committee, consisting of not more than twelve members, and other committees for special purposes as may be from time to time deemed expedient.

The succeeding sub-sections deal with matters of procedure associated with the District Boards.

GENERAL MEETINGS OF THE COUNCIL.

Rule VIII. sets forth that an annual general meeting of the Council shall be held in the last quarter of each calendar year. The business for which such meetings will take place is described; and provision is made for ordinary or emergency general meetings.

SECRETARY AND OTHER OFFICERS.

Rule IX. provides that the Secretary shall be appointed and his remuneration fixed by the Central Executive Board. The appointment of other officers is also arranged for.

Rule X. deals with the appointment of not less than two Trustees, and the investment of any moneys belonging to the Council.

The succeeding two rules relate to the appointment of an Honorary Treasurer, and to the accounts.

VOTING POWER.

Rule XIII. is highly important, and should be read in conjunction with the note in the explanatory statement. The rule reads:

(1) The chairman of a general meeting of the Council shall, in the first instance, if he think fit, take the decision of the meeting by voting by a show of hands; but any five members present may demand a poll, which shall be taken at such reasonable time and place, and in such manner, as the chairman may direct.

(2) On the taking of a poll one only of the two elected representative members nominated by any gas undertaking shall vote; and such members shall have one vote for any amount up to 250 million cubic feet of gas made by the undertaking he represents in the last preceding account year, and an additional vote for each 250 million cubic feet of gas so made in excess of the first 250 million cubic feet, and a further additional vote for any gas so made in excess of all complete quantities of 250 million cubic feet. All members other than elected representative members shall have one vote. No representative of an undertaking whose subscription is six months in arrear shall be eligible to vote. No member voted as an elected representative member shall be entitled to vote in any other capacity.

(3) At meetings of the Central and District Executive Boards or committees thereof the vote of each member shall be of equal value; but the chairman of any meeting of such board or committee shall also have a second or casting vote.

SUBSCRIPTIONS.

Rule XIV. may also be reproduced in extenso.

The subscription giving a gas undertaking a right to elect representative members of the Council in accordance with these rules shall be at the rate of one shilling for each million cubic feet of gas made by the undertaking in the account year preceding that for which the subscription is payable, or such smaller sum as the Central Executive Board may from time to time find necessary; but no subscription shall be less than one guinea per annum. Subscriptions shall become payable on Oct. 1 in each year. The Council may receive subscriptions in excess of those at the said rate, and may distribute the excess to any of the associated bodies, in accordance with the wishes of the subscribers.

COMMITTEE OF GAS EMPLOYERS.

In view of the interest attaching to this matter, we also give Rule XV.

(1) The Council shall form a separate committee, called the Committee of Gas Employers, which shall consist of only such of the elected representative members of the Council in each district as shall be authorized by the undertaking electing them to act as members of such committee and to bind their respective undertakings by any vote they may give on such committee.

(2) The Committee of Gas Employers formed in accordance with this rule shall have authority to carry out the objects referred to in Rule III. (6).

MISCELLANEOUS.

The remaining four rules deal respectively with the powers of chairmen, minutes, alteration of rules, and incorporation.

At the last meeting of the Yorkshire Section of the Society of Chemical Industry, Mr. F. W. Branson read a paper on "Some Aspects of the Scientific Glassware Industry." Pointing to the progress made in home production, he observed that several manufacturers who had entered the industry since the outbreak of war were now producing on a large scale; the output of one firm, from an improved formula, being about a million pieces per annum. In order to economize output, it was urged that quantity should be aimed at, and a quick method of graduating pipettes.

In the course of the proceedings at the annual meeting of the Federation of British Industries, Sir Robert Hadfield, Bart., moved a resolution (which was unanimously carried) dealing with technical education, and inviting the co-operation of the Government, organized labour, and educational authorities, with a view to improving technical and higher commercial education, to promoting the employment by manufacturers of students who had taken advanage of the courses provided, and to securing the introduction into industry of an adequate and a regular supply of suitably trained personnel.

PERSONAL.

Mr. HERBERT MARSDEN, of the Silsden Gas-Works, is about to sever his association with that undertaking, to take up the management of the Settle Gas-Works.

Mr. A. F. AMES has resigned the managership of the Silsden (Yorkshire) Gas-Works, on being appointed to the Padiham Urban District Council Gas-Works. The Assistant Manager at Silsden is Mr. Morris Driver, who is on military service; and the Council have decided to keep the managership open to be offered to him on his return. It has further been decided to urge the War Office to release Mr. Driver.

Mr. C. E. JONES has received from Mr. W. T. Dunn a letter, dated Oct. 25, offering him, in the name of the President, Council, and members of the Institution of Gas Engineers, their very sincere congratulations on the attainment of his 80th birthday. Mr. Dunn added: "It is felt that such a happy event should not be allowed to pass without this expression of the Institution's best wishes for your continued happiness with Mrs. Jones, who, as you have told me, has been your guide and counsellor, and we would include her in our good wishes." Writing to express his heartfelt appreciation of these congratulations, Mr. Jones said: "I emphatically assure you that I am deeply touched by this genuine and graceful remembrance of the event. My wife joins me in reciprocating most cordially their felicitations, so feelingly and eloquently expressed by your good self."

There will be general satisfaction at the news that Mr. SAMUEL GLOVER is to continue to serve the St. Helens Town Council, as well as the industry generally, in the thorough manner that has characterized all his actions for so many years past. Last year, when he could have retired on a superannuation allowance, the Gas Committee asked him to stay on; and he arranged to do so during the war. Now, however, that peace is upon us, the Council have again considered the matter, and have asked Mr. Glover to continue his work, with an additional £200 a year on his salary. Such a proof of confidence, after serving the Gas Company and Corporation for 47 years in the same works, must be highly gratifying to Mr. Glover, as it is to his friends—particularly as the Council are pleased for him to take all the interest he desires in serving the gas industry in every way he can. The minute of the Gas Committee that has been approved by the Town Council is in the following terms: "Resolved that after the war the Gas Engineer, Mr. S. Glover, be requested to remain in the service of the Corporation at a salary of £1000 per annum, of which £800 per annum shall be pensionable."

OBITUARY.

After having been with the Company for nearly half-a-century, Mr. C. H. BATTEN, the Secretary of the Northampton Gas Company, died at the end of last month, aged 67.

Mr. P. P. CHANNON, the Manager of the Haywards Heath and District Gas Company, died on Monday of last week, after a short illness from pneumonia, following on influenza. He was known to many readers, as he often joined in discussions at technical meetings. Indeed, as recently as the special meeting of the Institution of Gas Engineers he took part in the debate on the report of the Gas Investigation Committee. Mr. Channon had been about a quarter-of-a-century in the service of the Haywards Heath Gas Company; and during this time he worked his way up from collector to Manager and Secretary. He leaves a widow, son, and two daughters—the son being on military service. At the funeral, the coffin was borne by four employees of the Company; and several Directors attended. Mr. Trewby represented the Southern District Association of Gas Engineers; and there were present Mr. R. S. Tobey, of Horley, Mr. A. E. Whitcher, of Burgess Hill, and Mr. Melville Russell, of Elstree.

Midland Junior Gas Association.—A full day's visit to Chesterfield has been arranged for next Saturday. In the morning there will be an inspection of the works of the Bryan Donkin Company, Ltd., who hope to have on view some turbo-exhausters, as well as those of the rotary type. Luncheon will be provided by the Company at the works. Then in the afternoon there will be a visit to the bye-product works at Staveley of the Staveley Coal and Iron Company.

Arranging the Demobilization.—A Civil Department of Demobilization and Re-settlement (responsible to the Ministry of Labour) has been created by the Government; and of it Sir Stephenson Kent, K.C.B.—a partner in the firm of Messrs. Stephenson Clarke & Co.—is Controller-General. The Department will deal with all questions affecting the re-employment and re-settlement of the navy, army, and air force, as well as of civil war-workers. The Minister of Munitions has appointed a Demobilization Board to deal with all measures affecting the demobilization of munitions works and the liquidation of contracts, apart from the questions assigned to the Re-settlement Board under the Minister of Labour. The Board will include Sir Arthur Duckham and Sir Stephenson Kent. The Board will continue to be advised on Labour matters by the Re-settlement Board under Sir Stephenson Kent, who remains a member of the Munitions Council.

ELECTRICITY SUPPLY MEMORANDA.

ELECTRICAL people have never liked the British Commercial Gas Association. Their antipathy can be well understood. Once upon a time they themselves started a publicity organization on a small scale; but those who had the handling of it made a terrible mess of it, by going altogether the wrong way to work. It appeared to be thought that the main mission in life of the then Publicity Committee was first to slander gas in the best vindictive manner, and, as a good second part of the policy, to make the most extravagant and easily disproved claims possible regarding the performances of electricity. Another effort is now to be made, through the Commercial Electrical Development Committee, formed under the auspices of the Institution of Electrical Engineers. "Electrical Industries" announces that the new body is making good progress with its plans; and it utilizes the published information regarding the British Commercial Gas Association to stimulate its proceedings. It also warns the gas industry: "If the electrical industry is now going to bring the various applications of electricity before the public in an attractive form, the gas industry will have good reason to multiply its efforts to persuade the public that gas is the thing." The boot seems to be rather on the other leg. It is the electricity industry that is proposing to multiply its efforts through the Electrical Development Committee; and the article before us accentuates the view that this movement is not altogether destitute of connection with the existence of the British Commercial Gas Association. But the same writer seems to be a little doubtful as to the security of the foundation for confidence regarding what will happen to the new effort of the electricity industry. He urges the industry to beware of half-measures, and reminds it that it "is capable, without the slightest strain, of providing sufficient money to establish electrical publicity on the large scale which is necessary for the proper effect." He further cautions the new Development Committee against confining its publicity work to cooking and heating—even "for the present." "Anybody who suggests such a narrow policy does not understand either the business of publicity or the potentialities of the electrical industry." Altogether, the reading of the article suggests to us a little timidity and a want of robust faith in the scheme now before the electrical industry.

Electrical Development Committee.

The Electricity Ration.

There are other points in the same article. The writer of it does not approve of the plain speaking of Sir Hallewell Rogers at the recent meeting of the British Commercial Gas Association over the Fuel and Lighting Rationing Order. Sir Hallewell protested against the favour shown to the electrical industry in respect of the ration equivalent per ton of coal, compared with that allowed in the case of gas, despite the fact that the gas industry puts at the disposal of the Coal Controller about ¼ ton of coke from every ton of coal used, and at the disposal of the Government Departments high explosives, liquid fuels, a chemical manure, and many other things requisite to the war and to national industries. The electrical industry makes no contribution in any of these directions, but produces from the coal used nothing but electricity, on the basis of a barbaric thermal waste. The "Electrical Industries" writer thinks Sir Hallewell revealed his chagrin that the Government did not deal with the fuel question in a Prussian manner—for the benefit, of course, of "the national interest." That is just what the Government did do. They rode roughshod over all considerations affecting the results of the treatment of coal in gas-works and electricity stations, and gave the electric "fuel" consumers a ration which the producers of the electricity cannot justify in any manner; and the electrician makes a fool of himself who attempts to justify it—whether thermally or monetarily, or in coal saving, or from any other point of view. The Government smiled indulgently upon the poor case that electricity had, and exercised an unjustifiable generosity—shutting its eyes to the fact that electricity concerns were consuming anything between 2·8 lbs. per unit (1 ton per 800 units) up to 17·5 lbs. per unit (or 6¼ tons per 800 units), while totally destroying the whole of the constituents of the coal used. If any considerable amount of coal is consumed for generating electricity for heating purposes, the Coal Controller will be sadly out of pocket over it. The electricity fuel ration means gross uneconomy; and this no one can attempt to refute without courting disaster in the argument.

Electric Prepayment Meters and Higher Charges.

Prepayment meters have not made any enormous progress in relation to electricity supply; and they seem to have quite respectable drawbacks in these days when charges for current have soared up considerably. The question has arisen whether it is better to have the meters recalibrated to measure the new rates in force, or to discontinue the use of the prepayment mechanism, and convert the meters into ordinary registering ones. The Hammersmith Borough Council Electricity Committee have answered the question in the latter direction. So electric prepayment meters will no longer exist in the borough; and in these days of expensive current, the users of such meters will not be able to discharge

their electrical obligations as they go along, but will have to face an account (we presume) quarterly, which is just what they wished to escape, and did escape when charges were lower.

The Penalty of Economy.

The right to a minimum charge which electricity undertakings possess, and which is a distinctive feature in their legislation compared with that applying to gas undertakings, has been put into application with more general frequency since the appeals were made by the Coal Controller for economy of light. Originally, the minimum charge was fixed when carbon filament lamps were generally the vogue; and, truly, this type of lamp had a good appetite. With the coming of the metallic filament lamps, the bills of electric light users in the smaller houses, where frugal illumination is studied much more than in the larger ones, began to show an uncomfortable depression, having regard to the capital charges incurred in supplying consumers; and in some quarters—the summer ones especially—the consumption got very near to the minimum line, and in many cases below. In most Acts and Orders, the minimum is twenty units at the maximum charge—say, 8d. per unit, or 13s. 4d. as the minimum. Then came the appeals for economy; and the "patriotic," with the additional stimulus of increased charges, complied. Bills showing the minimum charge were the penality of this. Naturally rebellion ensued. Of course, there was something to be said for the electricity suppliers. Every consumer costs an undertaking money, quite apart from the mere cost of generating and distributing current; and there is a specific cost incurred by the supply of every consumer before the undertaking begins to earn even a fraction of profit. Come to that, the same thing applies fully in the gas business; but gas undertakings take the lean with the fat. However, all this is very plain. The electricity consumers who were penalized for their economy could not see the justice of the minimum charge in view of the urgent request made for economy; and their protests became so pressing that the Coal Controller could not refuse to take note of them. He evidently sympathized with their view that it was very discouraging to be charged for electricity which they did not consume. Sir Guy Calthrop has therefore been instrumental in bringing into force a new minimum. What he has arranged for is a new minimum charge extending over the year, and not a fixed charge per quarter as formerly. The charge is not to exceed £1 in respect of any one year, unless the practice has been to charge a less amount, in which case the less amount is to be the maximum. Adjustments are to be effected each quarter. For instance, where the minimum charge per quarter is (say) 5s., if a consumer only uses 3s. worth of electricity one quarter, and 7s. worth the succeeding quarter, the 2s. extra paid in the former quarter will be deducted from the account for the latter quarter. There cannot be much complaint about this. All the arrangement does is to ensure the payment of £1 per annum; but where the minimum was formerly 13s. 4d. per quarter, the annual minimum payment that could be commanded was £2 13s. 4d., without any question of adjustment as between quarter and quarter.

Newcastle and the North-Eastern Model.

The municipalities of the country are, as is well known, violently averse to anything being done in relation to the reports that have been presented to the Board of Trade and the Ministry of Reconstruction that does not put into their hands the controlling power in connection with any reformation that may be made in the electricity supply of the country. They feel that they stand to lose more than anyone else if the scheme for generating electricity in bulk gets into the hands of companies; and they can also see the value of the purchasing rights, exercisable after forty-two years, where companies exist, being grandly depreciated. The Newcastle-on-Tyne Corporation Parliamentary Committee think there is good reason to be apprehensive if the proposals of the two reports receive legislative sanction. They have Mr. C. H. Merz actually at their gates. The Coal Conservation Sub-Committee of the Reconstruction Committee had him as a member; and the North-East Coast Companies were held up in its report as exemplary of something which ought generally to be. *Verb. sap.* The reasons for the apprehension of the Parliamentary Committee of the Newcastle Corporation are that, if legislative endorsement be given to the reports, the monopolies of the private electricity companies in the district would be maintained and consolidated, and the publicly owned undertakings which generate and supply electricity in bulk in Newcastle-upon-Tyne and other parts of the North-East area of England, might pass from the ownership and control of the municipalities who at present run them, and be wholly dominated by a company or aggregation of companies conducted for private profit, enjoying (possibly with financial assistance from the Government) a monopoly of electrical enterprise in the area. At best, municipal electricity undertakers would be reduced to the position of distributors in their own areas of electricity supplied to them in bulk by the companies. This would be an awful blow to their dignity, as great almost as to the Kaiser dropping from his autocratic heights to a democratic level. But without arguing one way or the other, it would be highly interesting to learn whether local authorities consider that their dignity or the most economical public service (providing it is self-supporting) should be their ambition. If the latter, and we submit that it should control wholly the municipal attitude, then it is a matter for determination as to the best means of rendering the most economical service to the public; and whatever are the "best means" should receive the undivided support of the municipalities. We cannot understand any other attitude. Mere words are not a sufficient support of the Newcastle Committee's opinion "that it would be contrary to public policy that a public utility service of this character, which is a monopoly, should be under the control of private companies." Something of a more substantial order is wanted. Even if it were true that "the tendency during recent years has increasingly been to place such services under the management or direction of local representative bodies," the fact would not alone be sufficient vindication of the tendency. The tendency may have been a mistake.

Municipal Dissatisfaction Unabated.

The same Committee also let in a little light on the anxiety of Mr. Merz for the Government to do something—no doubt preferably on the lines of the report of the Sub-Committee of the Reconstruction Committee—when they pointed out that the Newcastle Corporation have a right of acquisition, within six months of July 3, 1922, of the city part of the undertakings of the Newcastle-upon-Tyne Electric Supply Company and of the Newcastle and District Electric Lighting Company. The Corporation themselves are already generators of elecricity for traction and power; so that the matter is one of some importance to the Corporation. The remaining four years' run in Newcastle is not a big margin, and it cannot be a pleasurable contemplation to Mr. Merz and his associates in the North-East Coast Companies. There is, however, in all parts of the country, to be a stout resistance to any usurping of municipal electrical rights; and in this resistance Newcastle intends to stand well in the front. Consultation is going on with representatives of other local authorities in the North-East area who are the owners of electricity undertakings; and from them a joint statement will go at an early date to the President of the Board of Trade as well as to the Minister of Reconstruction. Together with this, the Government is to be asked not to take any action on the reports except after an exhaustive inquiry, at which the municipalities should be represented to give evidence in the interests of the public at large. There seems to have been an exhaustive inquiry already; and if the Newcastle suggestion is heeded, the probability is that inquiry will be almost endless. What the Newcastle Corporation should ask for is an inquiry into the competence and impartiality of the members of the Committees selected, and whether their findings were in accordance with the evidence they had before them. We take it the municipal authorities were represented by their witnesses before the two Committees; and, if so, it might be as well to have something fresh to inquire into. Hence our suggestions. There is good precedent in the recent petroleum history. A Committee of the Petroleum Research Department looked into the question of liquid fuel, and made certain recommendations. The Ministry of Munitions appointed a Committee, presided over by Lord Crewe; and this Committee slaughtered the report and the chief recommendations of the Petroleum Research Department. So the game goes on right merrily. If the municipalities want further inquiry, they should challenge the recommendations arising from the previous inquiries being against the weight of the evidence and the facts adduced. Perhaps then they might be able to prove that it would be better to leave the municipalities the task of working out the electrical salvation of the country.

Gas in Soap Manufacture.

While soap making on a large scale seldom involves a very extensive use of gas, there are, it seems, quite a number of special soap compounds in the manufacture of which gas plays a most important part. Dealing with the matter in the "American Gas Engineering Journal," Mr. Gilbert C. Shadwell says that at present the boiling process is of chief concern to gas people; but there is little doubt that after-war conditions will bring about the wider use of gaseous fuels, and what is now being accomplished almost exclusively with coal will later tend to be carried out with gas, if the signs of the times are not mistaken. The process of soap-boiling is carried out in kettles of various capacities, up to about 30 tons, or even more. The old method was to apply to these kettles direct heat; but the general practice now is to use steam-heated kettles, though oil-jacketed, gas-heated, kettles can be employed, with or without a circulating system, with great advantage. While atmospheric burners of special construction are most valuable for the conversion of soap-kettles to gas, it is usually desirable to re-design the equipment, in order to get the best results; and careful consideration should be given to the conditions to be met. Mr. Shadwell explains the whole process of soap making; concluding with the remark: "Now is the time. Competitive days are coming; and the gas man must be prepared to meet them."

Society of Arts Cantor Lectures.—Among the arrangements for the current session of the Society of Arts, notification is made of the fact that a series of three Cantor Lectures will be given on March 10, 17, and 24 next year, by Dr. W. A. Bone, F.R.S., Professor of Chemical Technology (Fuel and Refractory Materials), Imperial College of Science and Technology, whose subject will be "Fuel Economy."

REPORTS ON APPLIED CHEMISTRY.*

LAST year the Society of Chemical Industry issued the first of a projected series of annual reports on different branches of applied chemistry. Each report was written by an accepted authority on the subject; and last year's volume, containing reports on fourteen branches of technical chemistry, comprised rather more than 300 pages of text, or an average of about 22 pages devoted to each subject. The reports recorded primarily the progress made in the year 1916.

The second volume of the series, dealing mainly with progress made during the year 1917, has now been issued. It extends to over 500 pages; and as it embodies reports on 21 branches of applied chemistry, the average space devoted to each branch is about 24 pages. In reality, however, the space is very unevenly allotted—the comparatively unimportant subject, from the technical-chemical standpoint, of the fermentation industries, occupies 45 pages; while plant and machinery is given only 8 pages. It behoves the Editorial Committee to see to it that, in subsequent volumes, the allotment of space is more in keeping with the importance and progressive character of the industry concerned. A most valuable feature of retrospects of the character of these annual reports is conciseness; and writers who are disposed to be prolix should be restrained by editorial authority.

The sections of the new volume of most interest to gas men are the first four. The first, by Prof. J. W. Hinchley, deals with "Plant and Machinery," and errs on the side of extreme brevity. It is general, and gives no detailed description of any particular item of chemical plant or machinery—presumably because there is nothing novel which the author has felt at liberty to describe and is of sufficiently outstanding value to merit more than passing reference. We hope that next year circumstances will admit of much fuller treatment of this subject, in which it is well known that war conditions have produced enormous developments.

The second section is on "Fuel," by Prof. J. S. S. Brame. In the first volume of these reports the "Fuel" section had been entrusted to Prof. J. W. Cobb; and a comparison of the two shows the great value of change of authorship year by year, since different aspects of the progress made in a particular branch are thereby furnished. Prof. Brame fills 35 pages, every one of which is replete with notes of value to gas men and all users of fuel.

There is naturally some overlapping of this section and the next two sections—those on "Gas: Destructive Distillation, and Tar Products," by Mr. E. W. Smith, D.Sc., and "Mineral Oil," by Mr. W. J. A. Butterfield. In the first volume, Mr. E. V. Evans was responsible for the "Gas" section; while "Mineral Oil" had been dealt with only in a few notes by Prof. Cobb which had been originally intended to form part of his section on "Fuel." Mr Smith must have found the task of reviewing "progress" in the gas and allied industires very difficult at the present juncture, when experts are at variance as to the most appropriate grade of gas for public supplies, having regard to the uses made of it and of the bye-products of its manufacture. No one, however, can quarrel with Mr. Smith when he makes the following statement:

> "Most gas undertakings have now adopted, for a period of years, the standard of 500 B.Th.U. gross; but owing to the serious depreciation in the results obtained in use from the gas supplied from many undertakings, there is a tendency to insist that there should be other standards besides that for calorific value. Those responsible on both sides will do well to avoid even suggesting the multiplication of standards until much more is known upon the subject. It is of national importance that heat energy in the form of gas should be supplied at the lowest possible price, and increased restrictions can but raise the cost of production. It is almost universally agreed that, should an ideal gas be produced, the questions of constancy of quality and pressure are overwhelmingly important."

Obviously all turns on what constitutes "quality" of gas for the bulk of the uses to which it is now put; and this problem is still under investigation by the various committees to which Mr. Smith subsequently refers. In the rest of his report Mr. Smith treats quite succinctly of such matters as the Recovery of Ammonia, Oil Washing, Naphthalene, and the Purification of Coal Gas. In dealing with the cracking of petroleum oils, Mr. Smith remarks that: "The manufacture of carburetted water gas is essentially an oil-cracking process; and the evidence so far available goes to show that a good quality benzene and toluene can be obtained by washing the gas from this process. In the early days of the war this source was unjustly ignored, owing to the lack of a good test for the benzol content of a gas." And, curiously enough, Mr. Butterfield, in the next report, harps on the same subject of the neglect of carburetted water-gas plants as a source of benzol. He says: "At the outset of the war, gas chemists pointed to the cracking of petroleum oil in existing or specially modified gas plants as the most promising means of securing a large production of toluol; and it is now only a question of price whether toluol so produced can hold its own in the market against the bye-product toluol of the coal-gas and coke-oven industries."

Mr. Smith's report is briefer than we could wish. But, taken in conjunction with Mr. E. V. Evans's report for the previous year, there is no better summary available of the progress in recent years in gas production and destructive distillation; and the Society of Chemical Industry have been singularly fortunate in these years of stress in securing the services of these two gentlemen as authors. Many, though not all, of the other sections in the new volume, are as good as these. Mr. Butterfield deals with mineral oil as succinctly as Mr. Smith deals with gas. His opening pages are devoted to a plea for the adoption of a systematized nomenclature for the more important grades and products of mineral oil; and, tentatively, he puts forward terms and definitions the acceptance of which would, he believes, avoid the confusion and overlapping which have hitherto prevailed, especially in connection with petroleum spirit and asphalt.

"Colouring Matters and Dyes" have again been entrusted to Prof. Gilbert T. Morgan, than whom no more competent reporter could be found. The section on "Acids, Alkalis, Salts, &c.," by Mr. H. A. Auden, contains a great deal of matter of interest to gas men, especially in regard to the production and supply of sulphuric acid, the utilization of nitre cake, and the synthesis of ammonia and other nitrogen products. In a later section by Mr. W. J. Rees, there is a useful summary of recent research and progress in the manufacture and testing of fire-bricks, &c.

In the foregoing comments, we have drawn attention only to those sections of most direct interest to gas men in a volume which, as a whole, is a very serviceable compendium of reports on the progress of applied chemistry. Having regard to the printing difficulties of the time there are few errors in the work—though Mr. Smith (on p. 66) is made to speak of a "low" carburetted water-gas plant, where no doubt he wrote "Lowe."

* "Reports of the Progress of Applied Chemistry" issued by the Society of Chemical Industry. Vol. II.; 1917. London: Society of Chemical Industry.

GAS FROM BITUMINOUS LOW-SULPHUR COALS.

Illinois Mining Investigations.

The difficulty due to war conditions of obtaining adequate and reliable deliveries of eastern gas coal and coke in the United States, has suggested the wider use in gas manufacture of low-sulphur coal mined in the central district, comprising Illinois, Indiana, and Western Kentucky.

The needs of the gas industry, and the desire of the United States Fuel Administration to meet the needs, has led to the appointment by Governor Frank O. Lowden of a Technical Committee on Gas Bye-Products and Public Utilities, to act in an advisory relation. The Committee includes representatives of the Illinois Gas Association, the United States Bureau of Mines, the Engineering Experiment Station of the University of Illinois, and the State Geological Survey Division of the Department of Registration and Education, State of Illinois.

Previously, some studies of the use of Illinois coal in retort-gas manufacture and in bye-product coke-ovens, and of the chemical and physical properties of Illinois coal, have been conducted under the Illinois Mining Investigations Co-Operative Agreement—a joint agency of the United States Bureau of Mines, the University of Illinois, and the State Geological Survey Division. The continuation and expansion of this work has been recommended by the Technical Committee and the Fuel Administration. In response, a Gas Section has been created, and experienced gas engineers, chemists, and other specialists have undertaken a programme of experiment on a commercial scale, to extend the use of central-district coal in water-gas generators and in gas-retorts.

The results of the investigations will be published, and, in addition, the operators of gas plants in the region naturally tributary to central-district coal will be advised by the Technical Committee of the progress from time to time, and will be urged to witness and participate in the tests, and to introduce in their own plants new or improved practices which will lessen the burden on the railroads, and assist the mines and the coke-ovens to meet the unprecedented demands due to the war.

Bulletin No. 21 of the Co-Operative Mining Series contains a long report on the subject, from the point of view of the manufacture of retort coal gas, by Mr. W. A. Dunkley, Gas Engineer of the State Geological Survey, and Mr. W. W. Odell, Gas Engineer of the United States Bureau of Mines. They say that a majority of the coal-gas plants in Illinois and neighbouring States have used central-district coals. While the gas yield is smaller and the coke made under present conditions is somewhat inferior to that from eastern coals, many plants are finding the use of central-district coals profitable. Since the use of these coals would do much to release railroad-cars needed for war purposes, it is a patriotic duty to use them. Furthermore, their use will serve to protect gas companies, because the supply will be more certain during periods of freight congestion. Experiences of many gas companies indicate that there are no insurmountable difficulties preventing the use of these coals for gas making.

The Institution of Heating and Ventilating Engineers are holding a special meeting at the Holborn Restaurant to-day to consider, among other things, the advisability of appointing a Committee to draw up practical suggestions and recommendations for securing economy in fuel consumption.

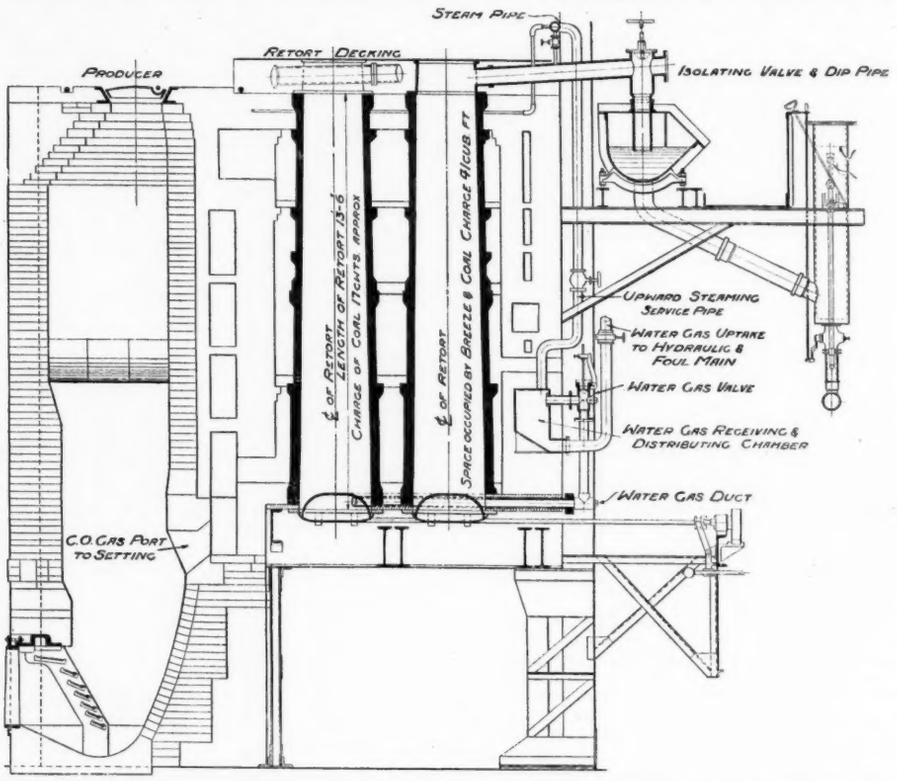
A REVIEW OF THE PRELIMINARY WORKING TESTS OF SETTLE'S DOWNWARD-STEAMING PROCESS FOR INTERMITTENT VERTICAL RETORTS.

THOMAS SETTLE AND GOODALL, CLAYTON, & CO., LTD., JOINT PATENTEES.

[COMMUNICATED.]

THE demand for tar-oils and ammonia, together with restricted supplies of coal and gas oil, necessitates a wider outlook than is included in a maximum make of gas, or in the highest calorific value per ton of material carbonized. The yield and the quality of the liquid residual products must also be considered. The degradation of heavy hydrocarbons due to decomposition while passing in contact with high temperatures through the vacant space in the retort, has hitherto been favoured rather than otherwise—notwithstanding naphthalene troubles, lower ammonia returns, and tar consisting for the most part of pitch and free carbon. But the new conditions call for closer control of secondary action, with a view of protecting hydrocarbons that would go to form tar-oils, or to contribute an important part of the heating value in the gas. In this direction we may look for a combination of the best possible yields of gas, tar, and ammonia; also for a remedy for the troubles incidental to high temperature carbonization as at present conducted, due to deposits of soot, pitch, and ammonia salts, immediately after the gas leaves the retort. Also about 50 millions; and for the past three years this has been met by a bench that, for practical purposes, may be regarded as comprising two beds of eight, and two of four, as one bed is so arranged that either half of it can be in use independent of the other. It was erected by Messrs. Goodall, Clayton, & Co., Ltd., of Leeds. The retorts are 13 ft. long, end to end, and taper evenly from a section of 27 in. by 14 in. at the bottom to 22 in. by 9 in. at the top; the short sides being semi-circular, and the long ones slightly bulged. The charge weighs 8½ cwt., which approximately occupies 11 ft., leaving 2 ft. clear above it. The practice during the tests was to fill the 60 ft. holder with an even supply throughout the week, and to empty it into the distributing system on Sunday, leaving it ready to deal with the next week's make. Samples transferred to test holders in the laboratory on Saturday gave a fair average of the week's work.

Full illustrated details of this intermittent vertical system of retort-settings have already been published in the "JOURNAL"—see Vol. CXXXIX., p. 276, and Vol. CXL., p. 72. The additions


STEAM PIPE
RETORT DECKING
PRODUCER
ISOLATING VALVE & DIP PIPE
UPWARD STEAMING SERVICE PIPE
WATER GAS UPTAKE TO HYDRAULIC & FOUL MAIN
WATER GAS VALVE
WATER GAS RECEIVING & DISTRIBUTING CHAMBER
WATER GAS DUCT
C.O. GAS PORT TO SETTING
LENGTH OF RETORT 13-6
CHARGE OF COAL 11 CWTS APPROX
SPACE OCCUPIED BY BREEZE & COAL CHARGE 9 CUB FT

SIDE ELEVATION, IN PART SECTION, OF SETTLE'S DOWNWARD STEAMING PROCESS FOR INTERMITTENT VERTICAL RETORTS.

we may expect better facility for the maintenance of uniform quality, and absolute permanency under all ordinary changes of temperature.

An extensive series of full-scale working tests under everyday conditions and contingencies—covering several varieties of coal and the entire make of gas for six weeks—has been carried out at the Truro Gas-Works, by the courtesy of the Directors of the Truro Gas Company and Mr. S. J. Ingram, the Engineer and Manager.

The objective was a uniform 500 B.Th.U. gas; and this was practically obtained. This figure is in agreement with the opinion of the Institution of Gas Engineers Gas Investigation Committee [see *ante*, p. 243], who state that their tests, so far as they have gone, point to a reduction below 500 B.Th.U. as inadvisable for the best efficiency. It was found quite possible to keep within limits of 10 B.Th.U. either way; and Mr. Settle, under this condition, has been able to show a yield of gas closely approaching 10 million B.Th.U. per ton of coal carbonized, or 20,000 c.ft., together with 12 gallons of tar-oils, and over 30 lbs. of ammonium sulphate.

In many ways the whole lay-out of the plant at Truro offered excellent facilities for sampling and measuring both the gas and the liquid products. It is of ample size compared with the output. During the summer a 60 ft. gasholder could be isolated; and the laboratory happens to be situated in the centre of the works, within easy reach from all parts. The annual output of gas is required to work the downward process are of a simple character, and comprise superheating coils and steam supplies on the top of the setting, and connections (controlled by valves) between the bottom parts of the retorts. A special disadvantage at Truro was the impracticability of adopting tubes larger than 2 in. diameter for the retort connections; whereas experience proves, as was anticipated, that 3 in. or 4 in. tubes are essential to really efficient work. Difficulties due to small connections were especially evident within the first two hours after charging.

Under present Government regulations, a make of 14,000 c.ft. of gas per ton is quite possible without steaming. On this basis the Truro results show a saving of at least 25 p.ct. of the coal consumed; while the improved yields of oil and ammonia enable this economy to be effected, without reduction of the present yields of these necessary products. This fact is worth the attention of the Coal Contoller; while gas directors and managers will appreciate the proportionate saving of labour and repairs to the plant.

If the sole object of admitting steam at the base of a retort is to cool the outcoming coke, without loss of heat, a cold and wet steam may be advantageous rather than otherwise, as the temperature may be raised by the waste heat to a sufficient extent, before it reaches the zone of decomposition. In the downward process, however, the steam at 30 lbs. pressure is superheated to 300° Fahr. before entering the top part of the retort. It passes into the gas outlet near the entrance, through a circular knife-

edge aperture ¼ in. diameter in a disc fitted into the steam pipe, and thence to the clear space in the retort above the charge. Its velocity is repeatedly checked; its temperature is further raised; and, instead of impinging on the incandescent coke at a high velocity that favours bye-passing through any fissure that may form in the charge, it approaches at a slow speed in a compact body equally diffused over the entire area. Steam is turned into each charge in succession, over the last quarter of a twelve-hour period, travels downward to the bottom connection, and thence to the base of a fresh charge, through which it travels upwards to the gas outlet. Each charge receives three hours' steaming down, and three hours' blue gas up.

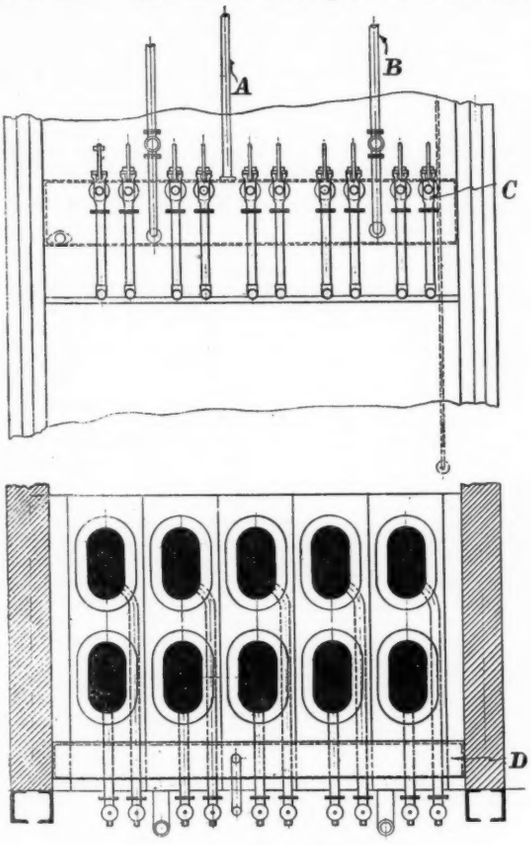
The advantage of the highly heated upward current of blue gas at the beginning of the working is a dilution of the rich gases without absorption or loss of heat, and a greatly accelerated speed of travel towards the gas outlet—resulting in a reduction of the secondary action due both to the protective influence of dilution, and the shorter exposure to a decomposing temperature. Consequently, the proportion of pitch in the tar falls below 40 p.ct., and the yield of ammonia rises 30 p.ct. There is a remarkable decrease in the temperature of the gases and vapours at the exit from the retort. Observations extending over six weeks showed an average of 130° Fahr., proving that the "dew point" (about 170° Fahr.) has been brought back from the usual position, somewhere well on in the foul main or close up to the interior of the retort. This effectively prevents deposits of ammonium salts in the hydraulic or foul main. The prolonged steaming completely washes-out the residual gases from the coke, as shown by the high hydrogen and methane content; and analyses of the gas suggest the existence of a wide field for study as to the actions and reactions that take place when the rich gases from the earlier periods of the charge are diluted with blue gases from a spent charge (due to dilution and conservation), the work really achieved in the way of "washing out" the coke, and the part that diffusive action may be taking, in a retort atmosphere rich in hydrocarbon content. The high proportion of hydrogen and methane, and the low content of carbonic oxide, indicate new conditions obtaining inside the retort.

When investigating the hourly production of gas, a set of four retorts was charged at one time, and steam was not used. The gas produced during the first hour would require 11 p.ct. more than its own volume of blue gas (310 B.Th.U. per cubic foot) to produce the standard quality, equivalent to a yield of 35,160 c.ft. per ton. The make during the second would be equal to 31,565 c.ft., and that during the third to 27,000 c.ft. per ton. The remaining nine hours would bring the total amount to 19,954 c.ft. of gas, or 9,977,000 B.Th.U. per ton of coal carbonized.

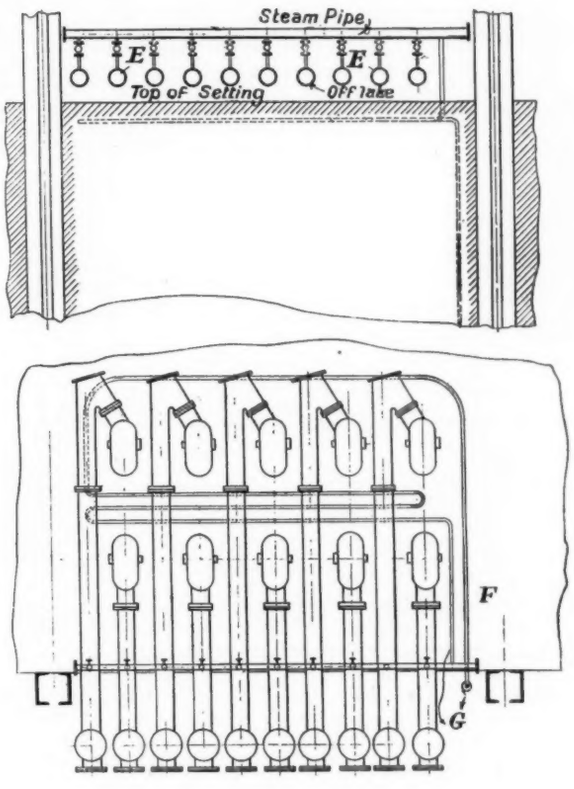
COMPOSITION AND CALORIFIC VALUE OF THE NEAT COAL GAS.

	First Hour.	Second Hour.	Third Hour.
Co_2	1·90	1·25	1·30
O_2	—	0·15	0·20
H_xC_x	4·00	3·80	3·60
CO	6·05	5·75	5·55
CH_4	48·50	42·90	36·05
H_2	34·90	41·05	47·90
N_2	4·65	5·10	5·40
	100·00	100·00	100·00
Calorific value, gross	711 B.Th.U.	670 B.Th.U.	618 B.Th.U.

Diagrammatic illustrations are appended; and the following descriptions of the charging and steaming cycles in a set of eight retorts will be studied with interest.



ARRANGEMENT OF WATER-GAS PIPES.



ARRANGEMENT OF STEAM PIPES.

A. Upward Steaming Service Pipe. B. Water-Gas Uptake to Foul and Hydraulic Mains. C. Inlet and Outlet Valves for Water Gas.
D. Water-Gas Chamber or Steam-Chest. E. Offtake Pipes. F. Pipes in Top of Setting for Drying Steam.
G. Steam, 30 lbs. per sq. in. at Inlet; Dried to 300° Fahr. at Main.

DOWNWARD PROCESS FOR STEAMING VERTICAL RETORTS.

CHARGING.

At 6 a.m. (and 6 p.m.)	No. 1 & No. 3
,, 9 ,, ,,	No. 5 & No. 7
,, 12 noon (and 12 midnight)	No. 6 & No. 8
,, 3 p.m. (and 3 a.m.)	No. 2 & No. 4

STEAMING.

6 to 9 (a.m. & p.m.)	5 & 7 down to	1 & 3 up
9 to 12 ,,	6 & 8 ,,	5 & 7 ,,
12 to 3 ,,	2 & 4 ,,	6 & 8 ,,
3 to 6 ,,	1 & 3 ,,	2 & 4 ,,

The gas outlet valve is closed during down-steaming in a retort.

The temperature of the charge during down-steaming ranges from 1000° C. at the bottom to 800° C. at the top. The average composition of the blue gas at the bottom connection during down-steaming was: 1·6, CO_2; 2·5, O_2; 32·35, CO; 1·67, CH_4; 64·2, H_2; 6·6, N_2. The gross calorific value was 310 B.Th.U. per cubic foot.

CARBONIZING TEMPERATURES.

The average temperatures in the setting outside the retorts were:

Combustion chamber	(bottom zone)	1330° C.
Centre ,,	(middle zone)	1170° C.
Top ,,	(top zone)	1120° C.

The following figures give some indication of the penetration of heat and the actual temperatures of the charge; and it would seem that the average temperature inside the retort is at all times much lower than that obtaining outside. The details are not put forward as being other than a reasonably close approximation.

TEMPERATURES AT CENTRE OF CHARGE.

—	Bottom Zone. Degrees C.	Middle Zone. Degrees C.	Top Zone. Degrees C.
End of first hour	200	170	150
,, second ,,	280	240	220
,, third ,,	370	320	300
,, fourth ,,	440	380	345
,, fifth ,,	470	405	370
,, sixth ,,	500	430	400
,, seventh ,,	580	500	455
,, eighth ,,	620	525	490
,, ninth ,,	950	820	745

COKE.

The average temperature found at the top of the spent charge was 800° C.; and at the bottom, 1000° C. The average of several experiments showed the loss of weight of coke, due to the use of steam by the down-process, as 2·34 p.ct. This would include any residual gases washed-out of the coke by the steam.

ADJUSTMENT OF FURNACE DRAUGHT.

Many careful records of tests taken at the dampers and air-slides, on different settings, warrant the deduction that a definite and balanced ratio exists between the relative area of outlet dampers, and the primary and secondary air-openings, which will produce constant conditions of draught as follows:

SUPERFICIAL AREA AND DRAUGHT.

	Area.	Draught.
Outlet damper	100 p.ct.	100 p.ct.
Primary air inlet	58 ,,	35 ,,
Secondary air inlet	54 ,,	50 ,,

These ratios will produce a standard draught of from 0·05 in. to level gauge at the top of the setting.

The following are fair samples of the composition of gas and of tar obtained from Yorkshire coal:

GAS.		TAR.	
CO_2	2·0	Water	5·4
O_2	0·7	Light oil	2·0
HC	3·5	Middle oil	32·4
CO	4·8	Heavy ,,	21·8
CH_4	32·1	Pitch ,,	38·4
H_2	48·7		
N_2	8·2		100·0
	100·0		

Specific gravity at 60° Fahr., 1·11.

The space at disposal (owing to shortage of paper) forbids more than a summary of the salient features; but the full text of the results has been submitted to several carbonizing authorities, and has attracted so much attention that arrangements for an installation of the system on a larger scale are in progress.

[It should be mentioned that the calorific values were taken day by day on a Simmance and Abady calorimeter, which had been adjusted and certified, and so are not merely the figures from a recording calorimeter. The knowledge of this point will give greater credit to the figures.]

Gas for Manufacturing Steel Balls.

According to a statement by Mr. E. J. Caspers, of the Public Service Company of North Illinois, reproduced in the "American Gas Engineering Journal," between 25 and 30 million steel balls for ball-bearings are being manufactured every day with gas as a fuel. The consumption of steel for this purpose alone is more than 500 tons a month. Gas equipment has made it possible to divert from 15 to 20 p.ct. of the heat of the gas to the forming of the balls, as against about 5 p.ct. under the old arrangement with coke as fuel in the muffle-furnace. There is likewise automatic control of the heat, which was impossible under the old method. In the ordinary method of manufacture, a drop-hammer is used in forming the string of balls; and the heat treatment is carried out in the muffle-furnace. Former requirements for ball-bearings in connection with bicycle manufacture were by no means so severe as the standards which must now be met in high-grade annular bearings. The automobile industry has been responsible for the raising of standards.

Standing Council on Post-War Priority.—Sir Henry Birchenough, K.C.M.G., who is on the Boards of the Imperial Continental Gas Association and of the Continental Union Gas Company, has been appointed Chairman of a Standing Council on Post-War Priority, appointed to assist the Cabinet Committee who are dealing with this subject. The Council have already had before them a survey of the existing stocks of the more important raw materials, and are giving urgent consideration to the question of releasing such materials from any form of control at the earliest possible moment.

REORGANIZATION.

By EVENING OBSERVER.

THE striking feature of the reconstitution scheme of the National Gas Council (which has been published in the "JOURNAL") is, of course, the total elimination of the Society of British Gas Industries in the proposals set forth. True, provision is made for co-opting representatives of the Society. They are to hold themselves in readiness when called upon to render assistance. How gracious!

One scanned the report of the meeting of the Council held on Oct. 17 to see what course the representatives of the Society took who were invited to attend; for, under the present regulations of the National Gas Council, nine of their members belong to the General Consultative Committee of the Council. The Society is not represented on the Executive Committee of the Council. Why this distinction was made it is difficult, if not impossible, to comprehend.

Greatly to the credit of the Society, no voice was raised at the meeting to state their case. The anomaly of attempting to form a perfect, united, and fully representative body, to act for the British gas industry, without including in it the vitally essential manufacturer, must have been apparent to everyone. Why should any further procedure be taken in the matter without first ascertaining from a meeting of the representatives of all the gas undertakings of Great Britain and Ireland, what their opinion is as to whether the manufacturer should or should not be admitted? The answer is surely a simple one. Either the manufacturers are desired or they are not.

Without any attempt at championing their case, it does seem to the writer as a Briton out for justice, that a fatal blunder will be made at this critical juncture in the history of the British gas industry if the manufacturers are ignored. They should be admitted on equal terms with all the other organizations whose names are down in the Council's scheme for reconstitution. Will not the administrators, the engineers, the chemists, the parliamentary representatives, &c., acknowledge that all the work they may do will be in vain, unless they have the genius of the manufacturer to carry their plans into execution?

Is the British gas industry indebted to the manufacturing engineer for any of the progress registered during the more than one hundred years of its existence? Scores of names could be mentioned of men of old whose successors belong to the manufacturing class whom the draughtsmen of the National Gas Council's new scheme would ignore. On the other hand, there are on the engineering side men too numerous to name, the successors of whom would be embraced in the proposed scheme. Would it not be an advantage for men of both types to meet together, confer, and by their united fraternal efforts to push forward our glorious industry, which is at this moment pregnant with possibilities for the benefit of mankind, and for the conservation of that substance which is the life-blood of our Empire? There can, the writer maintains, be but one answer to the question.

But says a possible critic, the administrators of gas undertakings and their engineers do not desire the presence of the manufacturer when they are discussing matters relating to policy, prices, and so forth. Does such a critic believe that the manufacturers would have any wish to be present on such occasions? They would retort, "We do not desire the presence of administrators and their engineers when we are discussing matters relating to our policy, prices, and so forth."

Let this matter be fully dealt with and, if possible, the advice followed of Lord Moulton, who is now President of the Society of British Gas Industries, as well as of the British Commercial Gas Association (having been, first of all, by the stroke of some genius, President of the Institution of Gas Engineers). His Lordship strongly advised his Society not to enter into any arrangement for the reconstruction of the British gas industry, which did not give his members an equal place with administrators, engineers, and other component parts of it.

Sir Hallewell Rogers, too, when retiring from his position as President of the "B.C.G.A.," urged "Unity, unity, unity." Alderman Kay followed on at the subsequent general meeting of the Association with the same plea; and other speakers demanded it. Then, why can we not have unity? Who are standing in the way? May they consider the grave responsibility of their attitude before it is too late.

It is announced that the Board of Trade have amended the Petroleum Products (Wholesale Prices) No. 2 Order, by substituting the sum of 3¾d. per gallon for the sum of 2¼d. per gallon, as the additional charge that may be made for the delivery of both gas oil and fuel oil in barrels *ex*-wharf.

Prof. H. Louis presided at a luncheon at the Cannon Street Hotel last week, at which M. Paul Kestner (the President of the Société de Chimie Industrielle) was the guest of the Society of Chemical Industry. One of the toasts was "The Society of Chemical Industry," submitted by Lord Moulton, and replied to by Mr. Charles Carpenter, D.Sc., who said that the Society began in 1881 with 300 members. Probably by the end of this year the membership would be 5000.

INSTITUTION OF GAS ENGINEERS.

LIFE OF GAS-METERS RESEARCH COMMITTEE.

Report on Corrosion of Dry Gas-Meters by Mr. J. G. TAPLAY, the Chief Analyst of the Gas Light and Coke Company.

The writer's attention was drawn to the matter of the corrosion of dry meters by Mr. B. R. Parkinson, early in the present year. On Feb. 11, 1918, Mr. Parkinson brought to No. 7, Tudor Street, some liquor which had been removed from a dry meter (No. 172,781) on the Fulham district of the Gas Light and Coke Company, and desired that it should be examined.

The results of the examination of this liquor are as follows. It consisted of three parts: (*a*) An oily part; (*b*) an aqueous part; (*c*) a solid part.

A.—THE OILY PART.

The colour is dark brown, and the specific gravity is ·909. It consisted of the following constituents:

	Volume per Cent.
1. Unsaturated hydrocarbons (liquid olefines) together with resins and naphthalene	94·5
2. Pyridine bases (nitrogenous)	5·0
3. Paraffines	0·5

The oil was saturated with naphthalene.

On evaporating the oil down to dryness, no sulphuretted hydrogen was evolved. After ignition of the dry residue, there was a residue of oxide of iron. The oil thus treated was filtered before evaporation and ignition; consequently the iron in some form is soluble in the oil.

The total amount of iron compound soluble in the filtered oil removed from the meter—viz., 115 cc.—and determined as iron oxide, is about 6 grains. It exists in the oil probably as ferro-carbonyl or carbonyl ferrocyanide.

Ferro-carbonyl, $Fe(CO)_5$, is produced by the action of carbon monoxide on metallic iron. It is a liquid at ordinary temperatures; but as contained in the gas, it would be in the form of a vapour. The ferro-carbonyl is easily decomposed by heat, and in the presence of air is converted into carbon dioxide and iron oxide—thus:

$$2Fe(CO)_5 + 13(O) = 10(CO_2) + Fe_2O_3$$

Oxide of iron from this source is often found deposited on the mantles and clay mantle-rods of incandescent gas-burners, on the steatite parts of flat-flame and argand burners, and on the fire-clay bricks and fire-clay fuel of gas-fires.

It is possible that ferro-carbonyl may react with the cyanogen products formed by the reaction of carbon bisulphide with ammonia, and yield carbonyl ferrocyanide.

B.—THE AQUEOUS PART.

This part was equal in volume to the oily part—viz., 115 cc. The colour is dark red-brown; and the specific gravity is 1·005. It has an alkaline reaction to methyl orange indicator; neutral to lacmoid; and acid to cochineal. It is also alkaline to reddened litmus paper, and neutral to turmeric.

An analysis of the liquor was made in order to explain this curious property; and the following constituents were found in the filtered liquor: (1) Pyridine bases. (2) Ferrous and ferric sulphate. (3) Ferric thiocyanate. (4) Ammonium thiocyanate. (5) Ammonium thiosulphate. (6) On evaporation of the liquor, there was a solid residue.

The alkaline reaction towards methyl orange and reddened litmus paper is due to the pyridine bases. The acid reaction towards cochineal is due to the ferrous and ferric sulphate, ferric thiocyanate, ammonium thiocyanate, and ammonium thiosulphate, which are all acid salts. The neutrality towards lacmoid and turmeric is due to the absence of free ammonia. The solid residue No. 6 was proved to be composed to some extent of leather substance which had become dissolved in the aqueous liquor. It should be remembered that this leather substance was found in the filtered liquor.

It will be observed that the bases of the pyridine group are present in both the oily and aqueous parts. This is because the lower members, at least, of this group are soluble alike in water and in the oily condensate of both coal-tar and oil-gas tar.

C.—THE SOLID PART.

The colour is dark brown, and the total weight is 23 grains. A little of the solid substance was gently ignited, and a smell of burning leather was observed. On analysis the following constituents were found:

	Per Cent.
Leather substance	91·0
Oxide of iron Sulphate of iron Sulphate of tin Sulphate of zinc	8·5
Sulphur in the free state	0·5

FURTHER INVESTIGATION.

The next part of the investigation took the form of observing and recording the effect of the solutions of the salts, &c. (which are often to be found in aqueous liquors condensed in dry meters), on tinned sheet-iron and on undressed and dressed meter-leathers. The various solutions and the tinned sheet-iron and the leathers were in contact for four months.

The various pieces of tinned sheet-iron used were cut from the same sheet; and this procedure also applied to the pieces of leather used. In the case of the tinned sheet-iron, each piece used was weighed before and after immersion in the solutions; and any loss in weight of metal was noted. Any alteration in the solution holding the metal was also noted. With regard to the leathers, the weight was not taken; but their condition after immersion in the solutions was noted, together with any change in the solution. The effect of each solution on the tinned sheet-iron and on the leathers is given below.

1.—OILY LIQUOR FROM DRY METER, NO. 172,781.

Tinned sheet-iron—
Weight before immersion . . . . . 1·670 gramme
" after " . . . . . 1·670 "
No corrosion.

Undressed Leather.—No leather substance was found after immersion. In the filtered oil, tannin, iron oxide, and lime were found; the leather was quite pliable.

2.—AQUEOUS LIQUOR FROM DRY METER, NO. 172,781.

Tinned sheet-iron—
Weight before immersion . . . . . 2·226 grammes
" after " . . . . . 2·200 "
Loss in weight = 1·15 p.ct.

Oxide of iron was formed; and as the oxide became dissolved in the liquor, ammonia was evolved.

The leathers were not immersed in the liquor, because leather substance had already been found in the residue.

3.—SOLUTION OF AMMONIUM THIOCYANATE $(NH_4)SCN$.

Tinned sheet-iron—
Weight before immersion . . . . . 1·914 grammes
" after " . . . . . 1·514 "
Loss in weight = 21 p.ct.

A large amount of iron oxide and ferrous thiocyanate was formed. As the oxide of iron became dissolved in this solution, ammonia was evolved; and, in the presence of air, red ferric thiocyanate was produced. The evolved ammonia is available for combination with a further quantity of carbon bisulphide. Some remarks on the reaction of ammonia with carbon bisulphide will be given at a later stage in this report—Section 12.

Undressed Leather.—After immersion, the leather was found to be black but pliable, and would not tear. In the liquor was a sediment consisting of leather substance. The filtered liquor contained tannin, iron oxide, lime, and leather substance dissolved in it.

Dressed Leather.—After immersion, the leather was found to be pliable, and would not tear. Much of the oil-dressing was removed. There was a sediment in the liquor containing leather substance.

In the filtered liquor, tannin, iron oxide, and lime were present, but no leather substance.

4.—SOLUTION OF AMMONIUM SULPHATE $(NH_4)_2SO_4$.

Tinned sheet-iron—
Weight before immersion . . . . . 2·321 grammes
" after " . . . . . 1·750 "
Loss in weight = 24·5 p.ct.

Much corrosion took place. Ferrous oxide was suspended in the liquid, and hard nodules of mixed iron oxides were clinging to the metal, which easily broke away, leaving perforations of the metal.

Undressed Leather.—After immersion, the leather was found to be black but pliable, and would not tear. In the liquor was a sediment consisting of leather substance. The filtered liquor contained tannin, but no iron oxide, lime, or leather substance.

Dressed Leather.—After immersion, the leather was found to be pliable, and would not tear. Much of the oil-dressing was removed. There was no sediment in the liquor, which contained only tannin.

NOTE.—Ordinary water will remove tannin from undressed leather, but not the iron oxide, nor the lime, nor the leather substance. In the case of dressed leather, none of these ingredients would be removed.

5.—SOLUTION OF AMMONIUM THIOSULPHATE $(NH_4)_2S_2O_3$.

Tinned sheet-iron—
Weight before immersion . . . . . 1·310 grammes
" after " . . . . . 0·940 "
Loss in weight = 24·5 p.ct.

Much corrosion took place; and a large amount of ferrous and ferric oxide was formed, some of which was in hard cake on the surface of the metal. As the iron oxide became dissolved in the solution, ammonia was evolved.

Undressed Leather.—After immersion, the leather was found to be pliable, and would not tear. There was a white sediment,

which proved to be sulphur. The filtered liquor contained tannin, iron oxide, and lime, but no leather substance.

Dressed Leather.—The same remarks apply as to the undressed leather. Some of the oil-dressing was removed.

6.—AQUEOUS SOLUTION OF PYRIDINE BASES.

Tinned Sheet Iron.—No corrosion is likely.

Undressed Leather.—After immersion, the leather was found to be pliable, and did not tear. The sediment in the liquor proved to be leather substance. The filtered liquor contained tannin, iron oxide, lime, and leather substance.

Dressed Leather.—After immersion, the leather was found to be pliable, and did not tear. The sediment in the liquor proved to be leather substance. The filtered liquor contained tannin, a little iron oxide, and a little lime, and a very small amount of leather substance. Much of the oil-dressing was removed.

7.—AQUEOUS SOLUTION OF A MIXTURE OF PYRIDINE BASES AND AMMONIUM THIOCYANATE.

Tinned Sheet Iron.—See No. 3.

Undressed Leather.—After immersion the leather was found to be pliable, and did not tear. A large amount of the sediment proved to be leather substance. The filtered liquor contained iron oxide and lime; and during the washing it gave a strong smell of burning leather.

Dressed Leather.—After immersion, the leather was found to be pliable, and did not tear. The sediment in the liquor proved to be leather substance. The filtered liquor contained tannin, oxide of iron, and lime; and on being ashed it gave a smell of burning leather. Much of the oil-dressing was removed by the liquor.

8.—AQUEOUS SOLUTION OF FERRIC THIOCYANATE.

Undressed Leather.—The liquor became a dark brownish-green colour; and a black sediment settled down—proved to be tannate of iron and leather substance. The filter liquor contained tannin and lime; and during ashing there was a smell of burning leather. After immersion, the leather was found to be pliable, and did not tear.

Dressed Leather.—After immersion, the leather was found to be pliable, and did not tear. The liquor became a brownish-green colour; and a black sediment settled down—proved to be tannate of iron and leather substance. The filter liquor contained tannin and lime; and during ashing there was a smell of burning leather. The pyrrol reaction during the ashing was very pronounced—indicating burning leather substance. Much of the oil-dressing was removed by the liquor.

NOTE.—While the fumes are being evolved from the nearly dry liquor, during ashing, if a piece of red deal moistened with hydrochloric acid is held over the mouth of the crucible employed for the purpose, when pyrrol (one of the products of the partial decomposition of leather, feathers, wool, horn, &c.) is present in the vapours, the wood will be stained a magenta colour.

Tinned Sheet Iron.—If the solution be wholly one of ferric thiocyanate, and therefore contains no ammonium thiocyanate, the sheet iron will not be affected.

9.—AQUEOUS SOLUTION OF A MIXTURE OF PYRIDINE BASES AND FERRIC THIOCYANATE.

Tinned Sheet Iron.—No corrosion likely.

Undressed Leather.—Similar result to No. 8.

Dressed Leather.—Similar result to No. 8.

10.—AQUEOUS SOLUTION OF A MIXTURE OF PYRIDINE BASES, AMMONIUM SULPHATE, AMMONIUM THIOCYANATE, AMMONIUM THIOSULPHATE, AND FERRIC THIOCYANATE.

Tinned Sheet Iron.—No experiment was made, as the results were obtained with the ammonium salts separately.

Undressed Leather.—After immersion, the leather was found to be pliable, and did not tear. There was a purple-coloured sediment, containing much leather substance. The filtered liquor contained tannin, oxide of iron, lime, and dissolved leather substance.

Dressed Leather.—After immersion, the leather was found to be pliable, and did not tear. Much of the oil-dressing was removed. A sediment containing leather substance and tannin settled down. The filtered liquor contained tannin, iron oxide, lime, and leather substance.

11.—MOIST SULPHUR DIOXIDE.

Undressed Leather.—After suspension in an atmosphere of moist sulphur dioxide for four months, the leather was found to be bleached white; and it tore easily.

Dressed Leather.—After suspension in an atmosphere of moist sulphur dioxide for four months, the leather appeared to be in the same condition as when first suspended in the gas. The leather was not bleached in any way, and did not tear. If, however, the oil-dressing is removed by solutions of such compounds as the pyridine bases, ammonium thiocyanate, thiosulphate, sulphate, or ferric thiocyanate, or mixtures of them, then the moist sulphur dioxide will cause bleaching and rotting of the leather.

Tinned Sheet Iron.—This experiment was not made, as the result is obvious. Sulphite and sulphate of iron would be formed.

NOTE.—The experiments quoted above were made to ascertain the effect of moist sulphur dioxide on meter leathers, assuming that the illuminating gas on leaving the works contained this impurity. It is always present in blue (uncarburetted) water gas, and is produced by the action of the air on the sulphur contained in the coke as ferrous sulphide during the "blow" and by the action of the steam on carbon and ferrous sulphide during the "run"—thus:

"Blow" $2(FeS) + 7(O) = Fe_2O_3 + 2(SO_2)$

"Run" $2(C) + 2(FeS) + 9(OH_2) = 9(H_2) + 2(CO) + Fe_2O_3 + 2(SO_2)$

Unless some special means be taken to absorb the sulphur dioxide (such as passing through slaked lime, soda ash, or ammoniacal liquor, or by reacting with sulphuretted hydrogen), it may make its appearance on the district. The reaction of sulphur dioxide with sulphuretted hydrogen may be shown as follows:

$$2(SO_2) + SH_2 = H_2SO_4 + 2(S)$$

That is to say, sulphuric acid and free sulphur are formed.

Here it may be noted that carburetted water gas never contains sulphur dioxide, because when the oil used (solar distillate) is "cracked," the nitrogenous bodies it contains are dissociated, and the molecules rearrange themselves as a simpler compound—ammonia, which product unites with the sulphur dioxide (formed in the genarator), and the result is ammonium sulphite and sulphate, which dissolve in the seal-pot containing water.

12.—REACTION OF CARBON BISULPHIDE WITH AMMONIA.

As both these compounds are constituents of coal gas, a study of them will be of interest.

The action of carbon bisulphide on ammonia results in the formation of ammonium thiocyanate (sulphocyanide), ammonium polysulphide, ammonium cyanide, and sulphuretted hydrogen as primary products. The ammonium cyanide is not found in the liquor when ammonium polysulphide is present in excess. Likewise the latter salt is not found when the former is in excess, as they react on each other, forming ammonium thiocyanate and ammonium hydrosulphide—thus:

$$NH_4.CN + (NH_4)_2S_2 = NH_4.SCN + 2(NH_3.SH)$$

The primary reactions are as follows:

$$3(CS_2) + 8(NH_3) = NH_4.SCN + (NH_4)_2S_3 + 2(NH_4.CN) + 2(SH_2)$$

Intermediate compounds—such as ammonium di-thiocarbamate $CS(NH_2)SH.NH_3$, and ammonium tri-thiocarbonate $CS_3H_2.NH_3$—are also formed, but are ultimately broken-down to simpler compounds.

The ammonium polysulphide, which is a dark red solution, is acted on by the oxygen contained in practically all coal gas, in more or less amount, and is converted into the colourless ammonium thiosulphate, with liberation of sulphur in a free state—thus:

$$(NH_4)_2S_3 + O_3 = (NH_4)_2S_2O_3 + S$$

Here we have one source of free sulphur often to be found in the liquor condensates and corrosion deposits in dry meters.

The ammonium thiosulphate is capable of further oxidation (much slower) to ammonium sulphate and sulphur dioxide—thus:

$$(NH_4)_2S_2O_3 + 3(O) = (NH_4)_2SO_4 + SO_2$$

The sulphur dioxide thus formed may react with any ammonia present in the free state, or with any sulphide of ammonia present, or with any sulphuretted hydrogen liberated, owing to some complex reaction taking place; or it may act on the metal parts or the leathers of meters, according to circumstances.

12A.—CARBON BISULPHIDE AND AMMONIA.

Solutions of CS_2 and NH_3 were mixed together in a flask having the neck closed. A lead acetate paper was suspended in the neck of the flask. In twenty-four hours the liquor was a red colour, and contained ammonium polysulphides, much ammonium thiocyanate, and much ammonium thiosulphate. The lead acetate paper became jet black, showing the presence of much sulphuretted hydrogen. The liquor had an alkaline reaction, owing to the presence of free ammonia.

The liquor was then boiled till all the ammonia was driven off. The liquor, after boiling, had an acid reaction; sulphur was precipitated; and the liquor became colourless.

A small piece of undressed leather was immersed in this colourless liquor, which latter became quickly red, and ultimately became a red-brown colour by reason of ammonium thiocyanate (contained in the liquor) dissolving the iron compound out of the leather, and converting it into ferric thiocyanate—the ammonia being evolved at the same time. A sediment was also formed which proved to be leather substance.

Some of the liquor was filtered and found to contain tannin, iron oxide, and lime—all from the leather. Another portion of the filtered liquor was brought down to ash; and while this was proceeding the smell of burning leather was very pronounced. The pyrrol reaction (red deal moistened with hydrochloric acid and held in the vapours) was also pronounced—thus proving the presence of soluble leather substance.

After the immersion, the leather itself was found to be pliable, and did not tear.

This experiment imitates the reactions and effects on meter leathers shown when describing the aqueous part of the meter liquor removed from dry meter No. 172,781 from the Fulham district mentioned at the beginning of this report; also when describing the effects with specially prepared solutions: No. 3, Ammonium thiocyanate; No. 8, Ferric thiocyanate.

12B.—Corrosion of dry meters has been more pronounced since the removal of crude benzol from the purified gas by heavy oil-washing. This crude benzol consists of benzene, toluene, xylenes, naphthas, phenols, creosote, liquid olefines in small amount, pyridine bases, and more complex bodies in small quantity. Naphthalene may be left out of consideration.

The writer has thought that all these bodies (present largely in the form of vapour) would, to a considerable extent, prevent

the energetic action of carbon bisulphide, ammonia, and water vapour.

NOTE.—Water vapour, although not shown in the reactions of carbon bisulphide with ammonia, must be present, in order to dissolve the products of the reaction as they are formed. Otherwise the reaction ceases very quickly. Perfectly dry carbon bisulphide and perfectly dry liquefied ammonia will react on each other only to a very limited extent. An experiment was carried out, which shows at any rate to some extent the retarding of the reaction of carbon bisulphide with ammonia.

Carbon bisulphide, in similar quantity to that employed in No. 12A, was mixed with crude benzol in the relative proportions that they would exist in coal gas, where the sulphur content is equivalent to 40 grains per 100 c.ft. of gas, or 47·5 grains of carbon bisulphide per 100 c.ft. of gas. The carbon bisulphide is thus equivalent to 0·03 p.ct. by volume. The benzol was taken as being equivalent to 0·5 p.ct. by volume, or about seventeen times the volume of the carbon bisulphide.

The mixture of carbon bisulphide and crude benzol was placed in a flask, and ammonia solution (similar in quantity to No. 12A) was placed in another small flask coupled-up to the first-named flask. Hydrogen was gently passed through the flasks until the contents of both had evaporated. A lead acetate paper was suspended in the path of the outlet vapours, which were afterwards condensed as far as possible. The condensed vapours were examined and similar products to those found in No. 12A were present, but in very small quantities, and the lead acetate paper was only a pale brown colour.

12C.—As this method of experimenting was not exactly the same as No. 12A it was repeated without the crude benzol, but using the same apparatus as for No. 12B. In this experiment the reaction of the carbon bisulphide and ammonia used was very energetic; the products formed being in large amount. The lead acetate paper became jet black. Thus it is seen that the presence of benzol, although not preventing the reaction of CS_2 and NH_3, in the presence of water vapour does retard the reaction and prevent the formation of corrosive liquids to a large extent. This retarding of the reaction is brought about by reason of the carbon bisulphide being in solution in the vapour of the benzol, and is thus "protected" to a large extent from the action of the ammonia, which is not in solution in the vapour of the benzol present, as it is not miscible with the hydrocarbons, &c., forming crude benzol.

FURTHER METER DEPOSITS.

On Feb. 28 the writer visited the Gas-Meter Company, Ltd., Kingsland Road, N., with Mr. Parkinson, in order to inspect some dry meters which had become corroded. Some corrosion deposits obtained from the valve chambers of three dry meters were brought away for examination, the results of which are given below.

A.—*Deposit from a Five-Light Meter, No. 10,519, removed from the Stratford District of the Gas Light and Coke Company.* This acid deposit yielded no pyridine; but it contained oxide of iron, sulphur, and ammonium sulphate.

B.—*Deposit from a Ten-Light Meter, No. 115,561, removed from the Stratford District of the Gas Light and Coke Company.* This acid deposit yielded no pyridine; but it contained oxide of iron, oxide of copper, sulphur, much ammonium sulphate, and much copper sulphate.

C.—*Deposit from a Ten-Light Meter, Gas-Meter Company, No. 713,247, from the Hornsey Gas Company's District.* This acid deposit yielded no pyridine; but it contained oxide of iron and sulphur, ammonium sulphate, and a little ammonium thiosulphate. The meter was found to be in a bad state of corrosion; but as no ammonium thiocyanate and very little thiosulphate were found, it is evident that these corrosive salts had become "spent" by dissolving the iron, which ultimately became converted into oxide of iron. Probably this "spent" condition was completed after the removal of the meter from the Company's district, and after air had entered the meter and the aqueous liquid had evaporated.

CORROSIVE SALTS AND THEIR ACTION.

A few remarks on the corrosive salts and their action on tinned sheet-iron and meter leathers will not be out of place here.

Tinned Sheet-Iron.—Ammonium sulphate and thiosulphate appear to be more active than ammonium thiocyanate. Only the two latter salts dissolve the oxide of iron formed and liberate the ammonia, which can combine with a further quantity of carbon bisulphide. Ammonium sulphate appears to produce more perforation of the sheet-iron than do any other ammonium salts—probably because the galvanic action set up is of greater intensity than that set up by ammonium thiocyanate or thiosulphate. With an aqueous solution of pyridine bases, no corrosion is likely to occur. This also applies to a solution of ferric thiocyanate. Moist sulphur dioxide would be very destructive towards the tinned sheet-iron, and very probably towards the brass parts of the meter—converting them into sulphites and sulphates of the metals attacked.

Undressed Leather.—Solutions of ammonium thiocyanate, ammonium thiosulphate, pyridine bases, ferric thiocyanate, remove tannin and lime, and the three former remove oxide of iron from leather. Sulphate of ammonia does not remove either iron oxide or lime from leather. With regard to the sediments containing leather substance, solutions of ammonium thiocyanate, sulphate, pyridine bases, and ferric thiocyanate, all cause this sediment to be produced; while ammonium thiosulphate does not cause this sediment to be formed. The clear filtered solutions of ammonium thiocyanate and of ferric thiocyanate both contained dissolved leather substance in fairly large quantity, and solution of pyridine bases in small amount. The solution of ammonium sulphate and thiosulphate contained no dissolved leather substance. The mixed solution of pyridine bases and ammonium thiocyanate gave more sediment containing leather substance; and there was more soluble leather substance in the filtered liquor than was the case when employing the solution separately. Moist sulphur dioxide causes the rotting of leather. The mixed liquor produced by the action of carbon bisulphide with ammonia [see No. 12A] also contained a sediment leather substance; the filtered liquor also contained tannin, oxide of iron, lime, and soluble leather substance.

Dressed Leather.—Solutions of ammonium thiocyanate, sulphate, and thiosulphate, pyridine bases, and ferric thiocyanate all remove the oil-dressing from the leather. Ammonium sulphate removes the least, and ferric thiocyanate the greatest amount. After the removal of the oil-dressing, the solutions of ammonium thiocyanate, pyridine bases, and ferric thiocyanate all contained a sediment of leather substance. Solutions of ammonium sulphate and thiosulphate contained no sediment. The clear filtered solution of ferric thiocyanate only contained dissolved leather substance in appreciable quantity. The remaining solutions either contained it in a very small quantity or none at all. All the filtered liquors except ammonium sulphate contained tannin, oxide of iron, and lime, derived from the leather.

Ferrous and Ferric Sulphate.—The effect of these salts on dressed and undressed leathers appears to be one affecting the extraction of tannin, oxide of iron, and lime. Leather substance is dissolved by solutions of both salts; but the leathers are not hardened by contact with the liquors.

PARAFFIN OIL IN METERS.

On March 7 of the present year the writer visited the Haggerston meter-works of the Gas Light and Coke Company, with Mr. Parkinson, to view and examine some dry meters which had been removed from the Kensal Green district. When the meters were opened, it was observed that the metal parts and leathers were in an excellent state of preservation. The surfaces of the metal parts were found to be coated with an oil having the odour of paraffin oil, which, when rubbed off, left the tinned sheet-iron almost like new metal, although some of the meters had been on the district for several years—in one or two cases, we were informed, twelve or fourteen years; in others four or five years. Oil having the smell of paraffin oil was removed from the meters and brought away for examination. There seems to be no doubt that this oil had preserved the metal parts and the leathers from the corrosive action of the products of the reaction of carbon bisulphide with ammonia, and the secondary reaction of oxygen with the products of the primary reaction. The Botley plant at the Kensal Green works has been in use for the past twelve or thirteen years; and evidently there has been ample time for the paraffin fog to travel from the works to the consumers' premises. The analysis of the oil removed from the dry meters brought away from the Kensal Green district is given below:

A. Total oil = 67 p.ct. (distilling between 80° and 350° C.).
B. Pitch = 33 ,,

A. of the total oil { Unsaturated hydrocarbons = 49 p.ct.
Aromatic hydrocarbons = 12 ,,
Paraffin hydrocarbons = 39 ,,

After viewing these meters, and noting their excellent condition, the writer suggested that dry meters brought away from districts should be sprayed in a general way with a paraffin distillate, which might very probably have beneficial results if the meter was not too far gone or damaged by corrosive liquids. The spraying would probably obviate the necessity of the meter being opened for examination, which procedure would, of course, necessitate closing it again before testing. Some solar distillate, such as is used for carburetting water gas, was therefore obtained, and experiments were made at the Haggerston meter-works with a small hand-sprayer selected and specially adapted to the work by Mr. Fagan.

We used a meter having a glass top and sides, in order to view the results. Most of the oil was deposited in the valve chamber; but, in addition, one could see a fog collected in the chambers on the outer side of the diaphragms, and a fog issued from the outlet of the meter, even with so heavy an oil as solar distillate.

We also tried the effect of spraying some dry meters removed from the Gas Light and Coke Company's district. Some of these meters had stopped working, and others were slow in registration. But, on being sprayed, all the stopped meters were again put into action; and when they were tested for correctness, some were found to be correct and others were slightly fast in registration. The meters that were previously slow in registration were either correct or slightly fast after being sprayed.

It was found that the cause of stoppage and slow registration was due in the one case to the valve sticking to its seating, and in the other case to the valve being slightly raised from its seating. The substance which causes this valve-stoppage is a sticky and gummy compound of the nature of resin, and is produced by the oxidation of a constituent of the tarry and oily condensates from the gas. When the solar oil gets into the valve chamber it dissolves this resinous substance; the valve is released; and the meter begins to work.

During the spraying of the meter, the solar oil is atomized. It

does not require much oil to produce the result; and the excess oil can be drained away from the meter.

The solar oil was thoroughly tested to ascertain if any such sticky substances could be produced from it by oxidation; and after a prolonged test (occupying about three weeks) it was found that no such compound was formed. Hence this oil is very suitable for spraying dry meters.

As to the effect of the solar distillate on the leathers of dry meters, it may be pointed out that the leathers of meters from the Kensal Green district were in perfect order after being subjected for several years to the fog of paraffin oil from the Botley plant. Paraffin distillates, if they have no acid reaction, therefore have another function in addition to the one originally intended—viz., the minimizing of naphthalene stoppages—and one not less important; and that is the prevention of the corrosion of the metal parts of meters, especially the tinned iron.

The amount of benzol removed from the gas is, roughly, 0·017 gallon per 100 c.ft., whereas the quantity of paraffin oil sprayed into the gas (at Westminster) is, roughly, 0·0015 gallon per 100 c.ft. The quantity of benzol is, therefore, rather more than eleven times the quantity of paraffin oil. To make up for this paraffin oil shortage it might be a distinct advantage to spray the dry meters with solar distillate before they are sent on the district. This would apply to both new and repaired meters. The solar oil is not intended to take the place of the leather dressing. In this way the surface of the metal parts would be thoroughly oiled and this would prevent the access of any corrosive liquids to these parts, although such liquids might collect in the meters.

Mr. Thomas Glover, of the Meter Works, Angel Road, Edmonton, is interested in this question, and is making special experiments with meter leathers and solar distillate.

PAPER, ON "UNACCOUNTED-FOR GAS," BY MR. B. R. PARKINSON.

In 1917 the Gas Light and Coke Company appointed a Special Committee under the presidency of Mr. Thomas Goulden, the Chief Engineer, to inquire into the subject of unaccounted-for gas. The deliberations of the Committee are not yet completed; and therefore the following notes do not represent their official conclusions. But the Company have given permission for any information obtained in the meantime to be put unreservedly before the Life of Gas-Meters Committee. Anything of value in these notes is due to the hearty co-operation of all the officials of the Gas Light and Coke Company, who have given of their experience, one and all, ungrudgingly. The result is a mass of information, from which the following is an attempt to make the briefest possible extract. Assistance has also been most willingly rendered by neighbouring companies, with whom notes have been compared.

The subject may be roughly divided under three headings: (1) Corrections; (2) Leakage; (3) Measurement.

1.—Corrections for Temperature, Condensation, and Pressure.

The following figures will give a rough idea of the influence of corrections on the volume of gas. The mean temperature of all the station-meters throughout the eight works of the Gas Light and Coke Company happens to be about 60° Fahr.; the mean temperature of the air can be taken as 49° Fahr.; and the temperature of the consumers' meters 54° Fahr., or 5° above the former figure. There is, therefore, a difference of 6° Fahr. (60° − 54°) temperature correction to make for shrinkage of volume as between the gas at the works and the consumers' meters. This is equivalent to 1½ p.ct. Corrections for saturated gas are approximately 1 p.ct. for 4° Fahr.; and no further allowance need be made for condensation. To set against this, there is a drop of pressure between the station-meter and the consumers' meters. Assuming the one to be 10 in. water gauge and the other 4 in., the difference (6 in.) represents an increase in volume of gas equal to about 1½ p.ct. Again 1 p.ct. to 4 in.

From the above it would appear that corrections for temperature and pressure may neutralize each other, and the conclusion may be drawn that to correct neither make nor consumption either for temperature or pressure, and simply take the difference, offers a fairly accurate figure for unaccounted-for gas—at any rate, so far as fluctuations are concerned. But station-meters may differ widely in their temperature between one works and another. The Gas Light and Coke Company correct their make to standard 60° and 30 in. barometer *plus* 6 in. water gauge—leaving their consumption uncorrected. On the whole year, this gives a figure of unaccounted-for gas annually which averages (on the make) ¾ p.ct. too much. Quarterly figures on the same basis would show a fluctuation quite at sea. For the present investigation the consumption of gas has been corrected quarterly for a period of ten

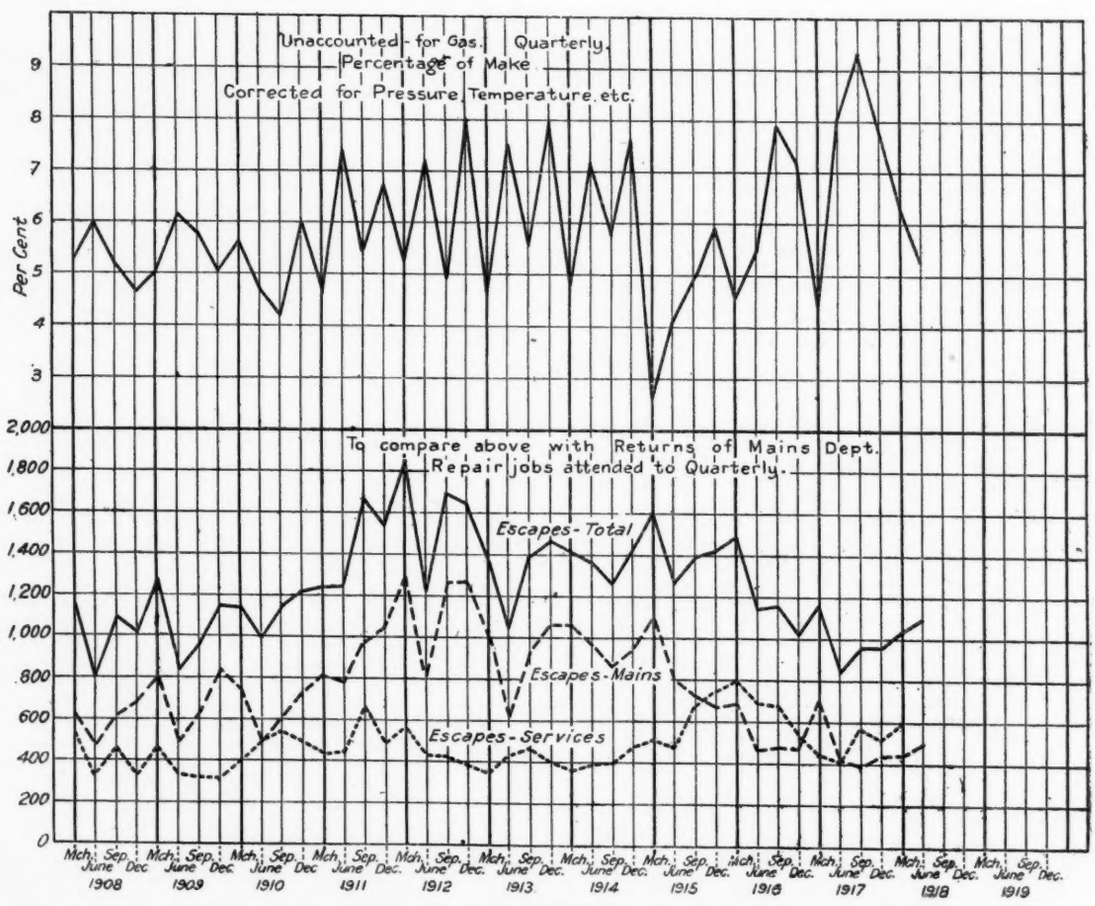

Unaccounted-for Gas. Quarterly.
Percentage of Make
Corrected for Pressure, Temperature, etc.
Per Cent
To compare above with Returns of Mains Dept.
Repair jobs attended to Quarterly.
Escapes-Total
Escapes-Mains
Escapes-Services
Mch. June Sep. Dec.
1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919

CHART I.

years to the same standard as the make; and these corrected figures form the basis of the charts that accompany this paper. [For notes on temperature, see Appendix.]

2.—LEAKAGE.

Mr. Stephen Lacey, the Distributing Engineer, in his memorandum on the subject of unaccounted-for gas written for the Gas Light and Coke Company in 1917, estimated that the leakage in mains and services is not greater than 1 p.ct. This estimate is deduced from the testing of certain sections of the Company's mains which were known to be leaking above the average. The results of each test were calculated out per foot run of joint, and multiplied by the total length of jointing throughout the system; and the product came to less than ½ p.ct. on the make of gas. Services are known to contribute less toward leakage than mains; and hence the conclusion that the total figure is below 1 p.ct. On Chart No. 1 it will be observed that variations in the unaccounted-for gas are not influenced by the fluctuations in leakage as indicated by the Mains Department's returns. On the contrary, when the unaccounted-for gas is down, it happens that the leakage is up. From this, it may be gathered that leakage fluctuations come within a range so small as to have little influence on the unaccounted-for figures; and that we must look elsewhere for an explanation of the extraordinary variations in the latter.

3.—MEASUREMENT.

Investigations of the Gas Light and Coke Company's figures proceeded on the following lines: For several years recently the unaccounted-for gas has been about 7 p.ct., according to published statements. In accordance with previous explanations ¾ p.ct. of this may be written-off for corrections; 1 p.ct. for leakage; and perhaps ¼ p.ct. for station-meters fast. It, therefore, remained to prove that the balance of 5 p.ct. was due to defective registration by consumers' meters.

THE YEAR 1915.

The published figure of 7 p.ct. for unaccounted-for gas which obtained in the years 1913, 1914, and 1916 dropped mysteriously in the year 1915 to 5¼ p.ct.; and this fluctuation was so definite and considerable that it afforded a unique opportunity for inquiry. A chart was made showing the behaviour of meters on the testing-bench over a period of years, and covering all the consumers' meters which passed through the Gas Light and Coke Company's testing and repairing stations—about 10 p.ct. annually of the whole.

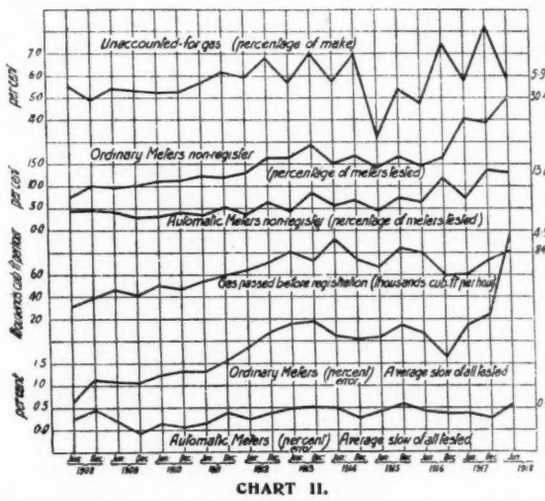

Unaccounted-for gas (percentage of make)
5.9%
5.04%
Ordinary Meters non-register (percentage of meters tested)
15.6%
Automatic Meters non-register (percentage of meters tested)
4.9%
$4,000
Gas passed before registration (thousands cub. ft. per hour)
Ordinary Meters (percent.) Average slow of all tested
0.6%
Automatic Meters (percent.) Average slow of all tested
percent
thousands cub. ft. per hour

CHART II.

This chart (No. 2) shows an improvement in 1915, particularly in regard to meters that passed gas without registration. Therefore a first definite clue was obtained which should go to establish some relationship between the unaccounted-for gas and the behaviour of meters.

UNACCOUNTED FOR GAS AND OIL.

To find out why the meters worked better in 1915, inquiry was made as to the conditions of gas-making from year to year; and it was ascertained, on the suggestion of one or two of the Company's station engineers—the first hint came from Mr. Lacey, sen., of Beckton—that more oil-gas was used in 1915, owing to shortage of coal in the early part of that year. This led to the remarkable chart (No. 3), which sets out the variations in oil against the unaccounted-for gas quarterly, and appears to show that the oil used for carburetting water gas is beneficial to the mechanism of the gas-meter. It was also inferred that the absence of such oil, together with the stripping of the coal-gas, tended to upset the working of meters and make them register slow to an alarming degree. [It may here be interpolated that quarterly returns of unaccounted-for gas are not usually regarded as reliable, but the Accountant's Department of the Gas Light and Coke Company have made a special study of this and have an ingenious system of regulating their returns of meter-reading.]

BEHAVIOUR OF METERS.

With the evidence of these charts as a hypothesis, it became necessary to try and obtain corroboration from the evidence of district inspectors and meter repairers, and at the same time to institute some research of a physical or chemical nature in the laboratory.

Mr. J. G. Taplay, the Chief Analyst to the Gas Light and Coke Company, became interested in the subject quite accidentally, but has since taken a great amount of trouble to cover the whole range of chemical and physical research. His report is before the Life of Gas-Meters Committee [*ante*, p. 359]; and as these notes are by way of introduction thereto, it may be well to give the briefest possible digest of his conclusions as they appear to the mechanical mind.

THE CHEMISTRY OF GAS-METERS.

It happens that those parts of the mechanism of a dry meter which are most intimately concerned with the registration are also the parts which are susceptible to the most rapid affectation by the constituents of gas. These latter are so brought to light in Mr. Taplay's report that the following three questions can now be satisfactorily answered: (1) Which constituents of the gas tend to remove the dressing from the leathers? (2) Which constituents tend to destroy the leathers after the dressing has been attacked? (3) What causes the gummy deposits on the valves; and how can these be removed?

(1) Mr. Taplay shows that certain chemical constituents of a complicated nature which remove oil-dressing from the diaphragms owe their formation to the presence of ammonia and carbon bisulphide in wet coal gas. As a matter of fact, ammonia alone would suffice to remove the dressing from leathers. The reactions are minimized in the presence of the hydrocarbons which have been removed during recent years from coal gas for munition purposes, and would likewise be mitigated by the presence of oil gas.

(2) The immediate destruction or bleaching of the leathers after the dressing has been removed is, on the other hand, caused by sulphurous acid, a constituent of blue water gas, but not of carburetted water gas. More gradual destruction is caused by the corrosive salts formed from the constituents of coal gas referred to in (1).

(3) Deposits of a resinous nature on the valves are left by the oxidation of certain constituents of tar oils, principally from carburetted water gas. When very little oil is used for gas-making, this oxidation or polymerization takes place readily, owing to the "dryness" of the gas. A plentiful use of oil in carburetting the water gas will either prevent the deposits or remove them, and thus restore the meter's registration. The same result is obtainable by the use of the paraffin vaporizer for the prevention of naphthalene, and also by spraying meters with an oil-fog [to be referred to later].

OIL-GAS AND MEASUREMENT.

It thus appears in all three cases the remedy is oil. It may be added that an oily gas also holds its water vapour better, and that conversely a "dry" or stripped gas would account for the increase of watery condensates found in so many meters to-day. The beneficent effect of oil-gas on meters is not a new discovery; for the Gas Light and Coke Company made special experiments after their first installation of carburetted water gas twenty years ago, and have on record that the leathers of meters were found supple and in good condition.

If the above is a reasonable attempt to clean-cut the problem of meter destruction, it would be interesting to follow up questions (1) and (2) and ask if gas engineers who make only coal gas find the leathers of their meters stripped of their oil, but not immediately injured in fabric; and whether those who make coal gas and water gas find the leathers not only stripped of their dressing, but bleached and perished. The repair shops of the meter makers hold a great deal of information on this subject which might be very usefully collated.

NAPHTHALENE.

Returns of naphthalene complaints, when plotted out in a chart, follow much the same line as the unaccounted-for gas. It is, therefore, evident that the conditions which affect meter registration (at any rate in the negative sense) are much the same as those which produce deposits of naphthalene; and the same remedy applies to both. But there is no direct chemical relationship between naphthalene and the meters.

CORROSION OF METALS.

Mr. Taplay's report deals equally with the constituents which affect the metal parts of a meter corrosively; and this is of equal gravity, although not bearing on the immediate and startling fluctuations in meter registration shown on the charts. Here, again, a film of oil on the metals will protect. Mr. Taplay refers in his report to the excellent condition of meters taken from one district of the Gas Light and Coke Company, where the gas had been saturated with oil-vapour for the purpose of naphthalene prevention. This was discovered by comparing returns of "stopped meters" from all the inspectors' districts throughout the Gas Light and Coke Company's area. "Stopped meter" is a somewhat misleading term used on the district to denote small meters that do not register with one light, or larger meters in proportion.

AMMONIA.

When Mr. Taplay's report had established the destructive influence of ammonia, it became of interest to plot-out the ammonia content of the gas on the same charts as the unaccounted-for gas and the oil. The result showed clearly in regard to the phenomenal year 1915 of the Gas Light and Coke Company. The

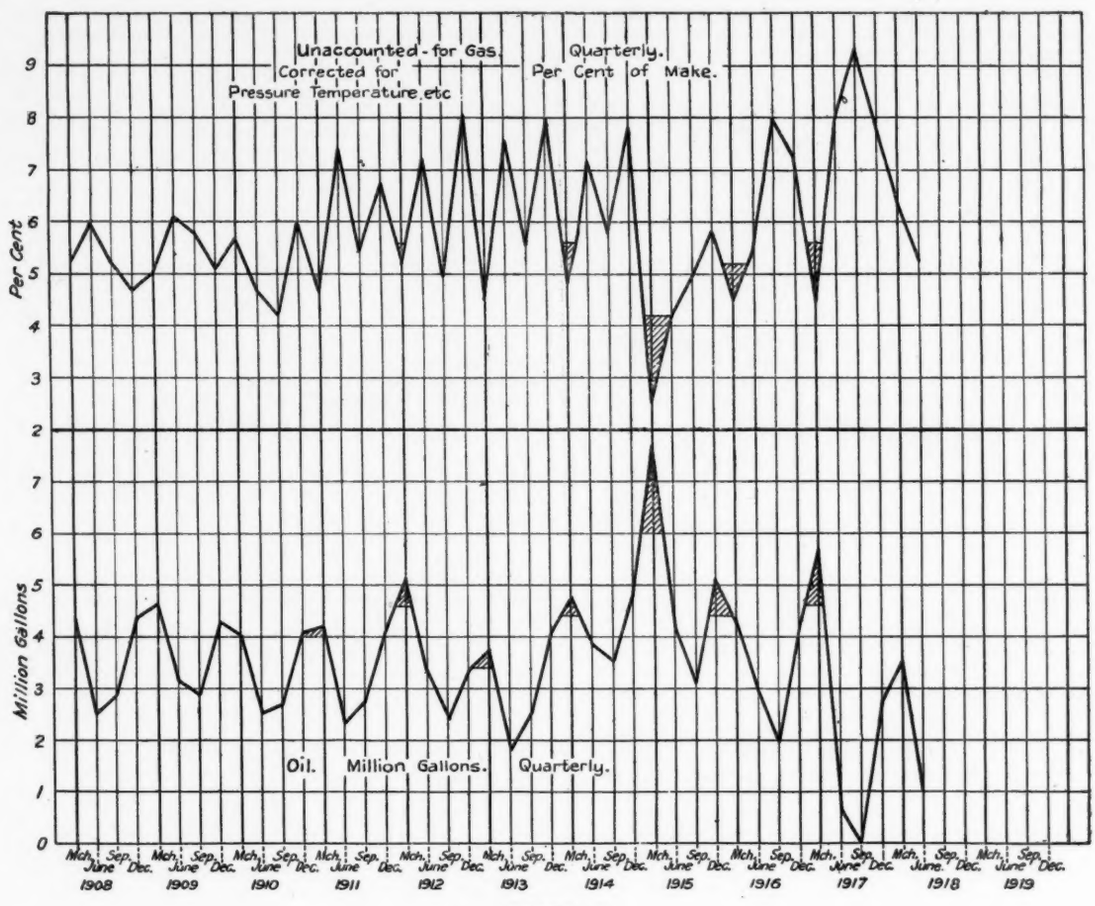


CHART III.

ammonia was then at its lowest; and thus it would appear that in that year the better behaviour of meters was due negatively to the freedom of the gas in regard to ammonia, and positively to the protection that is afforded by a high proportion of oil. [See Chart No. 4.]

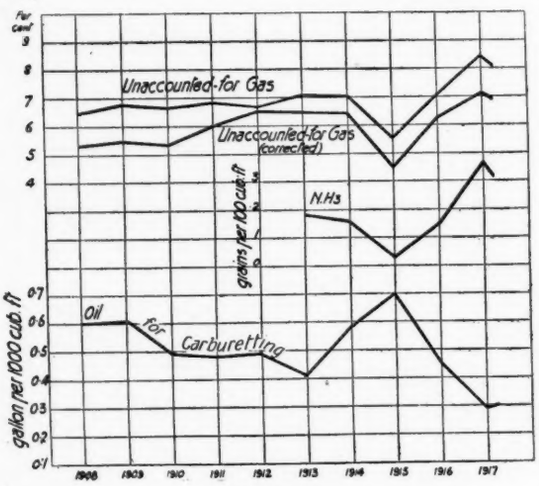


CHART IV.

Similar lines were plotted for carbon bisulphide and carbonic acid; but neither of these, so far as fluctuation is concerned, exerts influence. The CO_2 is known as an agent for corrosion of metals, but is overshadowed by the corrosive salts already referred to. Oxygen has been suggested in connection with gas-meter corrosion; and this element is dealt with by Mr. Taplay in the course of his report.

Evidence of Other Gas Undertakings.

Owing to the remarkable character of the oil-chart of the Gas Light and Coke Company, it was thought well to try and obtain corroboration (or otherwise) from the experience of other gas undertakings. Figures were taken from "Field's Analysis" and shown together in miniature on a chart. In many cases the lines appeared to run somewhat similarly to those of the Gas Light and Coke Company, but there were several that did not. Tottenham, for instance, in 1915 used more oil gas than usual, but yet the unaccounted-for gas was higher. By the courtesy of Mr. A. E. Broadberry, figures were obtained from Tottenham and plotted-out in regard to the testing of meters, and also the ammonia content. From these it appeared that in 1915, when the unaccounted-for gas was high, the meters brought in to be tested did actually indicate worse results, but that in the same year the ammonia was up. Apparently, the increase in the oil was not sufficient to counteract the influence of the ammonia. In the case of the Gas Light and Coke Company the great drop in unaccounted-for gas in 1915 appears to be due to a larger rise in oil and a very low ammonia content.

The report of the "Life of Gas Meters Committee," published in 1917, embraced an analysis of 301 replies received from various undertakings throughout the United Kingdom to certain questions asked. The analysis was made and tabulated by Mr. Cockey; and it contained much interesting evidence in line with the present investigation.

Spraying Meters.

The spraying of gas-meters with an oil-fog can be regarded either in the light of the complex chemical reactions dealt with so fully in Mr. Taplay's report or as a simple and reasonable means of lubrication. One cannot think of any other machine which is expected to work incessantly for such an indefinite number of years as the gas-meter, unlubricated and unattended. It is true that hitherto both the coal gas and carburetted water gas have supplied the lubrication inherently; and the meters have only suffered to a great extent in cases where gas undertakings have been deficient in their scrubbing plant [*vide* the report of "Life of Gas Meters Committee," 1916]. But the war has stripped the gas of its lubricating power; and a substitute must be found. Mr. Henry Woodall, to whose initiative much of this investigation is due, has several times drawn attention to this problem of gas-meter lubrication and its growing insistency.

There are three ways in which the spraying of meters can be applied: (1) New meters treated before sending out—as recommended by Mr. Taplay. (2) The treatment of meters that have come in for repair. (3) A travelling plant for periodically lubricating all meters on the district, or in parts of the district away from the immediate influence of oil-vaporizing plants. At present the second only has been put into practice both by the Gas Light and Coke Company and the Tottenham Company. Accumulated stocks of meters for repair can be greatly reduced by spraying, without breaking the seals. The immediate effect is to clean the slide-valves, and ultimately to soften the leathers and restore the mechanism to a normal working, so that slow meters become correct. Even prepayment meters which will not shut-off by reason of a deposit on the automatic stop-valve, are restored to working order by this simple expedient.

The apparatus used is the same as for spraying paint. A

long nozzle is passed down the inlet of the meter, and turned at right angles so as to shoot along the passage leading to the valve-box. The injector—or "pistol," as it is called—has a cup which holds about one-third of a pint of oil; and for each meter sprayed about half this quantity is converted into fog. Again, half of it is recovered from the meter by turning it upside down; so that only one-twelfth of a pint is actually expended. This means about a hundred meters (five-light or ten-light) to the gallon of oil. The meter is worked by the spray to the extent of several feet registration, and part of the oil-fog discharges at the outlet. The air pressure required for the best results is 35 lbs. per square inch. A good deal of experimenting has been carried out at Haggerston under the direction of Mr. W. Fagan, the Manager of the Stove and Meter Department, and the adaptation of the idea to practical working, as above described, is largely due to the ingenuity of the foreman, Mr. William Harris. The oil used is the same as for gas-making.

In the early part of this year references were made to the passing of petrol vapour through dry gas-meters in the discussion which followed a paper read before the Scottish Junior Gas Association. It has been found at Haggerston that the result from spraying a heavy mineral oil is equally effective and immediate in regard to cleaning and freeing the meter-valves, while the heavy oil gives the added advantage of lubrication. The City of Leeds Gas Department have also been experimenting on the cleaning of valves by passing hot paraffin vapour through meters.

Repairs and Renewals.

A return has been furnished by the Sales Department of the Gas Light and Coke Company, giving the full history of a meter that is repaired, from the time it is suspect on the consumer's premises to the time when it is returned and refixed. There is a summary giving the number of times it is handled, the number of times carted, and the average cost. In many cases all this has to be gone through, including the opening of the meter at the repair shops, just because of a little stickiness on the valves or dryness of the leathers. In war time this is serious; for on the one hand we have war-gas making the meters worse, and on the other hand meter-makers under the greatest difficulty in coping with repairs. Moreover, the gas company that is short of meters adds to its unaccounted-for gas by estimated consumers; for estimated accounts are not only, on the face of it, in favour of the consumers, but are frequently based on previous periods when the meter was beginning to run slow.

It is not within the province of this paper to go into the financial aspect of the matter; but it is of interest to note that the average cost of meter repairs to gas companies is 1d. per 1000 c.ft., and the value of 5 p.ct. of unaccounted-for gas may be taken at a like figure. This 1d. per 1000 c.ft. means an enormous sum to a large gas company; and in both these directions there may be a field for economy.

Unregistered Gas.

The Sales of Gas Act (1859) allows meters under twenty-light to pass up to one-twentieth of their capacity unregistered; and larger meters up to one-fortieth of their capacity. This means 45 c.ft. per hour on a 300-light meter. If all the meters in the Gas Light and Coke Company's district were to take advantage of the licence for only one hour a day, the loss of gas to the Company would be 500 millions per annum; while 1 p.ct. on the make is about 300 millions. This figure is given to show the possibility under the Act. An estimate of the total consumption by incandescent by-passes on the Gas Light and Coke Company's district amounts to just this figure of 500 millions per annum. Many of these undoubtedly take their gas unregistered even through small meters; and it is well known that large dry meters do not always worry about small consumptions. The Sale of Gas Act was passed long before the day of pilot lights. If all the meters on the Gas Light and Coke Company's district were to pass unregistered gas for one hour a day at the same rate as the 10 p.ct. that have passed through the Company's testing-stations, here again there would be 350 million c.ft. per annum, or over 1 p.ct. of the make. It may also be mentioned that carcase leakage, which amounts to very little with the individual consumer, but a considerable amount in the aggregate, probably passes the meters mostly unregistered.

Pressures Old and New.

The Sales of Gas Act (1859) requires that all meters be tested for percentage of error at normal speed and under the influence of 5-10ths pressure only. The tendency of a new dry meter when driven beyond its normal capacity should be to register slightly fast; but this depends on the accurate setting of the valves. Mr. Fagan at Haggerston has made a series of tests on repaired meters for overdriving. The tests cover a considerable range of speeds, and pressures from 5-10ths to 30-10ths. The following results are selected to give some criterion as to the actual behaviour of meters on the district. These are all meters passed as correct within the Sales of Gas Act (1859) at 5-10ths pressure and normal speed. With 30-10ths pressure and double speed, the average result is 1·8 p.ct. slow; with 30-10ths pressure and treble speed, the average result is over 3 p.ct. slow. The tests furthermore show that whatever fault a dry meter shows when overdriven is usually accentuated as the pressure is increased from 5-10ths to 30-10ths—the speed remaining constant. Therefore, although it is true that meters on the district are not overdriven all the time of their consumption in regard to speed, they are in the light—or, perhaps, the darkness—of the Sales of Gas Act (1859) always overdriven as regards pressure.

Overloading.

It is difficult even from the above figures to form an estimate of the proportion of unaccounted-for gas that is due solely to the overloading of meters. Much depends on the policy of a gas company in regard to the size of its meters or the control it can exercise in regard to the enormous increase of stoves, water-heaters, and other gas appliances with existing installations. The Gas Light and Coke Company's Sales Department were going very thoroughly into this matter just before the war broke out. [See notes in Appendix.]

Apportioning the Error.

Taking the Gas Light and Coke Company's figures, if 5 p.ct. of unaccounted-for gas be allocated to consumers' meters, the following division might be suggested: The Sales of Gas Act allows a bias of ½ p.ct. in favour of the consumer, this being the average of 3 p.ct. slow and 2 p.ct. fast:

(1) Bias allowed in new meters	½ p.ct.
(2) Slow through overdriving	1 ,,
(3) Unregistered gas	1½ ,,
(4) Slow owing to condition of meters	2½ ,,
	5 p.ct.

Of these, it will appear that only the last two (3) and (4) will possibly be affected by the process of spraying meters for cleaning and lubrication as previously described.

APPENDIX.

The following notes may be of interest:

Ordinary meters are, on the average, harder worked than prepayment meters.

Ordinary meters are not so well off as prepayment meters in respect to position and temperature on the consumers' premises. More condensation is found in ordinary meters; and there are fewer cases of non-register with prepayment.

The location of dry meters makes all the difference to condensation within, and the consequent upsetting of valves and leathers. In a block of flats the only meter affected (if any) will be the one on the ground floor.

Valve troubles in dry meters are worse than diaphragm troubles. A weak leather with clean valves will go on for a long time; but dirty or sticky valves upset all the working.

Meters that have been encased in thick wooden boxes because of their exposed positions—known as "box-meters"—have always been long-lived. This is a very old expedient.

The deleterious constituents of gas which attack tin-plate do not affect solder nor lead-coated steel plate.

Before the war, unaccounted-for gas in the town used to be lower in the September quarter (the holiday season), and greater during that period at the seaside. During the war, owing to changed conditions of consumption, munition work, &c., this has ceased to be apparent.

A gas cooker as usually supplied with prepayment installations consumes about 60 c.ft. per hour at 20-10ths pressure and 75 c.ft. at 30-10ths. This is with all burners in use. The 75 c.ft. is two-and-a-half times the normal capacity of a five-light meter.

It is an old saying in the Gas Light and Coke Company's Sales Department that "an inspector can earn his salary by watching his meters." Each inspector's district is provided with a set of standard burners of different capacities, and regulated to 1 in. pressure, for testing meters *in situ*. Even without these, it is a simple matter to prove the sensitiveness of a meter by watching the test dial with a small light, and thus look out for cases of unregistered gas. All accounts are regularly and carefully scrutinized in relation to size of meter, so as to watch for cases of overloading and other possible irregularities. But this comparing of accounts does not detect slowness of meters that has come about very gradually from quarter to quarter. This can only be met by practical attention to the meters themselves.

Tests of station meters are apt to be misleading, because they are carried out at a speed so very little compared with the normal working. A small perforation of the drum will make the meter appear slow under test, but would be inappreciable as a percentage when the meter is passing large quantities of gas. Therefore the water-line should not be altered to agree with the test-meter unless the drum has been first proved in respect to soundness. To clean-out a station meter periodically, sound the drum, and maintain the water-line. These are of more importance than to test; for a wet meter has none of the vagaries that may, under variable conditions, characterize the dry.

Less than 3 p.ct. of the Gas Light and Coke Company's output is measured by wet meters. Undertakings, such as Birmingham and Sheffield, that have a larger proportion of wet meters, show less tendency for their lines of unaccounted-for gas to rise in recent years.

The following are average temperatures of the air in London over a long period of years. The quarters start from the middle of the previous month to allow for meter readings. Thus, the March quarter is from the middle of December to the middle of the following March.

March 40°. June 51°. September 61°. December 48°.
Mean Summer 56°. Mean Winter 44°. Year 50°.

Taking into account the greater consumption of gas in winter than in summer in proportion 3 : 2, the average for the year comes to 49° Fahr.

Discussion on the Two Preceding Papers—pp. 359 and 362.

The PRESIDENT (Mr. Samuel Glover, of St. Helens): Your Joint Committee, called the Life of Gas-Meters Committee, have accepted these reports for presentation to you, and for discussion, as they thought you would like to have the matters brought before you in this way. It has been decided that the discussion of the two papers shall be taken together. We have with us by hearty invitation representatives of the firms who are manufacturers of gas-meters; and we want them to have an opportunity, if they desire to do so, to speak at this meeting. I also want everybody else who wishes to mention anything to you to have the chance of doing so. To any member who may feel that he would like to send along a contribution, or to add anything after the meeting to his remarks to-day, I extend an invitation to do so. The Joint Committee on the Life of Gas-Meters feel that they are doing a very important work; and they appreciate the responsibility of their present action. They desire you to help them in this way to bring to light every bit of useful information that you can. I think you will agree that we have met for very important work at a very important time in the history of the gas industry, and that our calling you together has been well justified, even at this period of the year.

Mr. Fred. G. Cockey.

Mr. F. G. COCKEY (Chairman of the Gas-Meters Section of the Society of British Industries), referring to the diagrams, said: Probably further inquiries would bring forth explanation of the cases where the increase or decrease of unaccounted-for gas does not correspond to the variation in the quantity of oil used. In one of the cases at least, I know that the drop in the unaccounted-for gas is attributable to the fact that a thorough and systematic overhauling of mains, services, and meters had been undertaken about the time that the reductions took place. I consider that the thanks of the gas industry are due to the Gas Light and Coke Company for their public spirited action in undertaking the work and placing the results freely at the disposal of the Institution. I have always urged that the Committee could only arrive at reliable conclusions by collecting and tabulating records which must be in the possession of many of the larger undertakings. The makers can only record the state in which meters come back for repair, and the number of years during which such state has been attained. They can have no knowledge of the particular conditions, chemical or physical, under which the meters have been working. The war and the depletion of staffs which have resulted from it have affected both the gas undertakings and the makers of meters, and have almost entirely prevented the systematic prosecution of the inquiry. The Gas Light and Coke Company are to be congratulated on having secured the services of a gentleman like Mr. Parkinson, who not merely possesses the special knowledge, but was able to devote the time necessary to carry out an investigation on such extensive lines. I trust the example of the Company will be followed by other large undertakings which have the means of carrying out investigations on similar lines, but under their own special conditions.

Mr. Parkinson's report, in as far as it deals with corrections for pressure, temperature, &c., and leakage, appears to point to the fact that losses through slow and non-registering meters form by far the larger part of the unaccounted-for gas in the case of this particular undertaking; and from my experience during the last few years—more especially during the war—I am quite prepared to believe that this is generally the case. The deposit found on the valves is, in my opinion, alone sufficient to account for a very large proportion of this loss; and I agree with Mr. Parkinson's conclusion, that the trouble is worse than diaphragm defects, as it allows a constant small loss which is difficult to detect from the quarterly readings; whereas the failure of a diaphragm very soon shows itself by such a marked drop in the gas registered that attention is at once called to it. The deterioration of leathers takes place to such very different extent in meters of the same make and age, and in the same district, that it is extremely difficult to arrive at any definite conclusion as to the cause. Mr. Taplay has furnished some very useful data bearing upon this, which should be of great assistance; but we require to know the history of a large number of meters, the position in which they are fixed, the extent to which they are overworked, and other local conditions, in order to discover why the diaphragms of one meter dry and crack, while in another they remain flexible and sound. The diagrams submitted by Mr. Parkinson, and the information given in Mr. Taplay's report, as to chemical action, appear to show that the presence of uncracked oil in suspension in the gas has not only a protecting, but a cleansing and lubricating effect on the working parts of the meters. One would like, however, to have further evidence from other districts, as well as further information regarding concurrent conditions as to sulphur compounds, ammonia, oxygen, and CO_2 present in the gas, before finally accepting the oil cure as a panacea for all the ailments of the dry meter.

If it is found, after more extended experience, that there are no injurious after-effects, and that the correct registration of meters can be materially prolonged by the introduction of oil in the form of spray or mist, I think it would be found that not only the cheapest, but the most effective, way of using it will be to introduce it into the gas at the works, or at different points on the district, for a few hours at the period of maximum consumption daily, or at any rate at regular intervals. In this way, the action of the oil would be continuous, and the meters would be always in the oily condition aimed at. On the other hand, oil-spraying *in situ* must necessarily be done at long intervals; and to get round the meters in a large district, once a year even, would entail a large staff, and would be very costly, while the effect would, I feel sure, pass off in a very short time, owing to the draining of the oil down to the bottom of the meter-case and its absorption by the stripped gas passing through it. I should just like to refer to the interesting contribution by Mr. Lacey published in the Oct. 15 issue of the "GAS JOURNAL." The proportion of lost gas attributed to leakage in mains and services is so small that I cannot help thinking it is exceptional, and is highly creditable to the Distribution Department. As Mr. Lacey admits, conclusions may be very different in other districts; and from my own experience on country districts, I am satisfied that the amount lost in this way would generally be more like 3 p.ct. I hope, therefore, that we shall hear from gentlemen in other parts of the country who are in a position to give the results of their own observation. Mr. Taplay's communication, as a record of facts ascertained by tests extending over several months, under what may be considered working conditions, is a most valuable contribution to our knowledge of the destructive influence at work during the life of a gas-meter. It is particularly valuable in calling attention to the injurious effect of traces of ammonia and the cyanogen and salts produced by their reaction with other constituents of the gas. It would be interesting to know whether Mr. Taplay has been able to collect a sufficient quantity of the black deposit found on the valve-face for a complete analysis. I have only been able to get a qualitative analysis made; and this indicated that the substance consisted principally of iron sulphide. This, gradually increasing for some years past, has become much more serious since the reduction in the quantity of oil used for carburetting, and the consequent absence of the lubricating effect of the oil.

A Practical Demonstration.

The PRESIDENT: I will now ask Mr. Parkinson to give a demonstration of the spraying, and will also ask him to touch on the subject of the treatment of dry meters *in situ*. Are you suggesting that meters can be treated *in situ*?

Mr. PARKINSON: Yes. My idea was to have a travelling motor van, with a pump and compressor inside, with the view of disconnecting the meter from the consumer, bringing it out in the van, spraying it, and then taking it back again. Mr. Goodenough was very nervous as to what the consumer would say if we were to do anything of the kind in the house of the consumer. In fact, we are thinking of doing the whole thing while Mr. Goodenough is away on his holidays. [Laughter.]

Mr. R. E. Gibson.

Mr. R. E. GIBSON (Liverpool): I should like to say a few words on this question. I think it is a very important and valuable contribution that we have had, and it is particularly interesting to me. Our experience at Liverpool bears out what the authors of the paper have said. We have not had any trouble due to the deterioration of the leathers in dry meters; and we have a large number of dry meters of the prepayment pattern. We have had some trouble, however, with regard to the valves. We have noticed the presence of a gummy substance on the surface of the valves; but this has not been so apparent during the past few years. In regard to wet meters, Mr. Parkinson referred to Liverpool. I have not the figures of unaccounted-for gas with me; but I believe the percentage has not gone up during the last few years. Practically the whole of our ordinary meters are of the wet pattern. Our percentage of unaccounted-for gas is much higher than we like, and the matter has been engaging my attention. I have come to the conclusion that the leakage is largely due to the form of meter that we are using, and to the antiquated Sales of Gas Act. The meters are tested at 5-10ths pressure; and they go out on to the district, and are subject at once to 40-10ths pressure. The water is blown out of the meter down the overflow, and we have a low water-line at once; and in consequence the meters register against us. This, I think, is a defect which can easily be overcome; and we are now constructing meters which will not act in that way. There is just one other matter in regard to wet meters. We have discovered a defect which does not affect the unaccounted-for gas, but is a very serious matter—that the wet meter, when on the low water-line, is liable to close-off the gas, and then allow the gas to come on again. This might have very serious consequences; and, in my opinion, it is a defect which absolutely condemns the wet meter as ordinarily supplied. We have been going into the matter, and think we have got over the trouble. We are now constructing a meter which has not this disadvantage.

Mr. A. E. Broadberry.

Mr. A. E. BROADBERRY (Tottenham): I feel that this subject is a very important one, and much regret the time is getting so short that I fear there will not be opportunity for a full discussion of it. I would, however, like to say a few words of appreciation of the excellent work that Mr. Parkinson has been doing in investigating the causes of the alarming increase that most of us have experienced in the unaccounted-for gas. When Mr. Parkinson, knowing that we had been very large users of water gas, and consequently have to employ great quantities of oil, came to see me

I was so struck with the diagrams he submitted to me referring to the Gas Light and Coke Company, that I felt he was absolutely on the track of the remedy for the trouble, and the cause of the increase in the unaccounted-for gas since many of us have reduced the quantity of oil that we had been using. I fully expected that our experience at Tottenham would quite confirm his conclusions from his diagrams; and it was certainly a disappointment to me—as I know it was to Mr. Parkinson—when he found the year 1915 was very contrary at Tottenham. Then subsequently, when Mr. Taplay started on the other theory, and we supplied the figures for Tottenham, I think that, as Mr. Parkinson pointed out, we found the solution—that the increase in ammonia during 1915 was counteracting the good effect of the increase in oil, and that the increase in oil was not able entirely to stop the bad effects of the increase in ammonia. I think the investigations of Mr. Parkinson and Mr. Taplay have pointed out a very grievous cause of the bad registration of meters, and a certain degree of remedy; and that the investigations followed on these lines will help us very materially. The remedy of the oil-spray we have already adopted at Tottenham; and we can quite confirm all the beneficial effects that Mr. Parkinson expects from it.

Mr. F. H. Robinson.

Mr. F. H. ROBINSON (Harrogate): There is one point that has come out in the reading of the papers, and in the remarks of Mr. Broadberry—the question of the ammonia content of the gas. The figure of 3 to 5 grains appears on the high side; and the question arises, Has the composition of the water used in washing anything to do with it? In my own experience at a country works, the water contained 18° to 20° of hardness; and 60 p.ct. of it was permanent hardness. It was impossible to remove the ammonia. You could get it on a piece of litmus paper at any time. The works which I at present control are supplied with a soft water; and we get our ammonia content down to under ½ grain. It seems to me that the analysis of the water would be useful in each case. With regard to the question of lubricating meters, you put a piece of machinery to work—a steam-engine or anything else—and you supply a lubricant. You put a dry meter to work, and you expect it to work satisfactorily in a dry state.

Dr. R. Lessing.

Dr. R. LESSING (London): I should like to make one or two remarks on the reports, and particularly to add my hearty congratulations to the Institution and to the Committee on having secured these two papers. As you know, I have done some work on the subject. I must confess that the scientific way in which both Mr. Taplay and Mr. Parkinson have proceeded is the one that ought to be followed in all cases of this kind. If I may take Mr. Taplay's paper first, one or two matters interested me particularly. One is the fact that Mr. Taplay establishes beyond any doubt at all that leather substance is dissolved in the liquid deposited in gas-meters, and also in solutions of compounds which are often found in the meters. I mention this because soon after the first report submitted to the Life of Gas-Meters Committee (to whom I have had the honour to report on the technical side), a paper appeared by Mr. M. C. Lamb, of the Leather Sellers' Institute, who had worked on behalf of the South Metropolitan Gas Company. In this paper, which was published in 1916 in the "Journal of the Society of Chemical Industry,"* Mr. Lamb doubted the possiblity of leather being dissolved in meter liquors, and pointed out that any leather substance found in these liquors must be due to shavings or dust produced in the buffing of the diaphragm leathers. I am much obliged to Mr. Taplay for confirming the accuracy of my own results. As to the question of interaction of carbon bisulphide and ammonia, I am pleased to say I pointed out in my first report that such action does probably take place—that any thiocyanate found in these liquors was more than likely due to this interaction. At the time, of course, I hardly realized that this reaction—upon which I looked only from the point of view of the deterioration of the meters themselves—could ever have such far-reaching influence on the sale of gas. Now, on this point I should like to ask whether figures have been calculated as to the quantitative effect of this reaction. Mr. Taplay quotes a figure in his paper for carbon bisulphide calculated on the volume occupied by the gas. But does the quantity of carbon bisulphide *plus* the ammonia which may be removed by the action from the gas actually account for such a large proportion of the percentage of unaccounted-for gas as shown by Mr. Parkinson? I am not quite sure that it does, and believe its effect to be an indirect one. I should like to offer one other suggestion in this direction, and that is that the reaction is not the only one that is likely to take place.

If I may first speak on the question of carburetted water gas, I am doubtful that the effect observed is due to a spray of oil sent through the pipe system in any way similar to the spray that is being used as a remedy in the meter. I do not know whether it has ever been stated before that the carburetting agent is carried forward in oily form. I have no doubt some is; but I have my doubts whether the relation of the oil gas to the unaccounted-for gas is of the same order as the effect of the oil-spray put in the gas-meter. I rather believe that the difference is due to the composition of the gas. We have in carburetted water gas a gas entirely different from ordinary coal gas. I should like to remind members of the remarks of Lord Moulton yesterday, the significance of which I heartily appreciated, that we have to look on gas as being something very much unexplored; and that we know very little about the minute constituents of either coal gas or carburetted water gas. I believe that great importance is to be attached to the composition of the gas. The percentages of hydrogen, methane, &c., are easily settled; but I refer more particularly to the very minute constituents, and would like you to remember that out of perhaps 1 to 1½ p.ct. of the volume of the gas in the shape of crude benzol we can recover in a collected form more compounds than all the compounds put together in which we usually try to express a gas analysis. Among these compounds, there are some which are particularly liable to be arrested in the gas-meter. As I pointed out on a previous occasion, the gas-meter acts as a final scrubber for the gas. These compounds, apart from ammonia and carbon bisulphide, are largely unsaturated hydrocarbons which we have come across lately in various connections—particularly in the hydrocarbons for motor purposes obtained by cracking. They have a way of forming those gummy residues which we find in the shape of deposits on the valves, where they easily explain the slip of gas through the meter. Is it not possible that these reactions are equally, if not more, responsible for the extraction or abstraction of gas from that which is measured? I am taking the two papers together. If we consider that the repair shops of meter manufacturers and gas companies extract a very considerable amount of oily substance per annum from the meters, this must, if expressed in terms of gas, which it undoubtedly was before deposit, amount to some quite appreciable figure in cubic feet. I should not like to make the calculation without having data; but in a case like that of the Gas Light and Coke Company, if all the oil extracted from the meters in their district was accounted for, and the gasification figure—or rather the gas of which it consisted before being polymerized or deposited—was taken, I believe we should get a total which would amount to quite an appreciable portion of the unaccounted-for gas. This would be apart from the carbon bisulphide and ammonia reaction, which also extracts some. So I do believe that these compounds are worth further investigation, and, if possible, on the lines on which the other compounds have been tested.

There are just one or two questions I should like to ask Mr. Taplay. In the corrosion experiments on tin plate with the various solutions, was the tin plate merely cut, or were the edges tinned over again? This is a very important point, as with the open edges, of course, galvanic couples of iron and tin are formed, and the dissolution of the metals is easily explained. If iron is found with a plate tinned all over, one has to resort to some theory that the solution or the gas penetrates through the pores in the tin coating.

The PRESIDENT: You are referring to the cut edges of the tin plate?

Dr. LESSING: Exactly. The plate which Mr. Taplay used for placing in the various solutions. The next question refers to the free sulphur which Mr. Taplay found in the complicated reaction which he mentions. Is it possible that any free sulphur found in the meter is actually obtained in this way? Or is it a question of spent oxide dust that is carried forward? Since I wrote my report in 1916 I have come across a number of instances of the transport of oxide from the works throughout the district. They are of a most striking character. I may mention the case of one very important company, who were faced about eighteen months ago with the apparent danger of their main system and service-pipes becoming altogether corroded by cyanogen. They asked me to look into the matter; and on doing so I found that this indeed was not the case. They were very much relieved to hear that they would not have, in five or ten years, to replace their mains. Owing to the deposits they found accumulated in their mains, and right up to the meters, they could extract daily almost ½ cwt. of black dust. In this case I could establish by analysis that the trouble was due only to fine oxide dust; and by altering the working of the purifiers, and installing special means of removing the dust, the difficulty is being entirely overcome. In view of these facts, it is more than probable that the very finest dust is carried to the meters, and on to the valve-seatings.

Mr. Alexander Wilson.

Mr. ALEXANDER WILSON (Glasgow): I am sure we are all indebted for the careful way in which these investigations have been put before us. The trouble that has been taken over them has been very great: and I think the Committee will feel that the result has well repaid it. With reference to Mr. Parkinson's paper, no doubt his figure of 1 p.ct. for leakage may well apply to London; but in places like Glasgow, where we are close to colliery districts, and have sinkings of the ground beneath (so much that in some cases we have to keep gangs continually in special districts), I am quite sure it must be more; and I would like to know whether he considers any correction need be applied. In works where the temperatures of the meters are much above the normal—as they are in a good many cases—I think the corrections are necessary to give us some fair idea of what the leakage actually is. In our case in Glasgow, we are not complicated with water gas; so that the question of the quantity of oil used before or after the year referred to does not apply. Nevertheless, we had the same difficulties in that year, although we had no water gas, and no use of oil; and it was really a most serious trouble. We have, of course, as most other large undertakings have, been helping the Government in extracting benzol and toluol; and we put the dryness of the gas down as the cause of the trouble in our meters. No doubt, there is a certain amount of fact behind this theory. At the same time, the question of the ammonia coming

* See "JOURNAL," Vol. CXXXVI., p. 184, Oct. 24, 1916.

forward, I believe, also has an important bearing on the subject. The meters brought in increased alarmingly; so much so, that I had them examined. It was not possible to work the moving parts at all, or scarcely at all; and we actually had to hammer them. Therefore, I tried a method of lubricating on the meters which were being brought in. I applied it in a slightly different form from what has been shown this morning. I vaporized some paraffin, and passed this through with an air-blast. We have an air-blast running down our shop for heating the irons of our tinsmiths. I rigged up an apparatus, and put a measured quantity of paraffin down a tube, heated the tube, and vaporized the paraffin. We found, as the result of dealing with thousands of meters, that it was well worth the trouble of doing. We kept a careful note of the meters sent out, and have only had one of them returned again. This was due to a breakdown in the measuring apparatus. The lubrication seems to have been sufficient; and if something in this way could be done in the district, it would be a great matter. But one feels that to spray everywhere in the district would be rather difficult. Though you can apply it at close quarters, if you were to put it into the main I am afraid it would not carry. Some of it might; and it might be worth while trying. Some of the larger meters might well be sprayed in position; and if this prevented the diaphragms from getting stiff, it would be an important saving.

Mr. Ralph Halkett.

Mr. RALPH HALKETT (Glasgow): There is just one other point, and that is the diaphragm. A great deal has to do with the preparation of the diaphragm with the present gas we are having. I think the makers use olive oil alone. Personally, I have found that a mixture with a certain amount of blacklead in it retains the oil, and does not allow the gas to pick it up so quickly. Only a day or two ago, I was passing through the workshops and there was a 500-light meter and a 400-light meter. The 500-light had been treated just with the olive oil; and the 400-light had been treated with the mixture. The 400-light had been out for four years, and the 500-light two years. The diaphragm of the 500-light meter was dry and broken away in several parts of the rim; but the 400-light meter, which had had the preparation, was as good as when it was sent out. This is a serious matter, because with the present price of diaphragms it is very expensive to replace them. Another point in connection with the unaccounted-for gas. They give it as 1 p.ct. from the mains and services. I must congratulate the Gas Light and Coke Company on the very efficient way in which they maintain the works, because I cannot conceive any undertaking at the present time working with 1 p.ct. of unaccounted-for gas on mains and services—not even London. Things are quite different now from a few years ago. The heavy traffic in streets like those of London, I consider, has a very great bearing on the unaccounted-for gas. There is also the method of working. We can take any undertaking we like, there is always somebody ready to shirk work; and I am sorry to say that at the present time it is not unusual to see a main and service layer using the gouge and the rimer.

The PRESIDENT: You mean for boring out a main?

Mr. HALKETT: Yes. Rather than get a drill, they will use a gouge; and this means gas going away all the time. It is a thing that should not be done in any gas department.

Mr. T. S. Lacey.

Mr. T. S. LACEY (London): From what I understand from Mr. Wilson, his figures have not been complicated by the use of oil gas. That is to say, the alteration in the unaccounted-for gas with which he has dealt has not been complicated by the question of the use of more or less oil gas. I think that is so?

Mr. WILSON: Yes.

Mr. LACEY: There is another factor bearing on this question, and that is the removal of benzene and other substances from the gas. Everyone acknowledges that the gas, since it has been stripped, and also since the oil has been reduced, has been drier, as it is called. When the benzene and the toluene are removed either partially or wholly, I think they always partially remove with them the high boiling-point oils with low vapour tension; and my opinion is that the removal of these has been a great cause of the trouble. It has been overlooked that, removing the benzene and the toluene, we are removing at the same time the lubricants which made the gas greasy in the old days; and I do not think sufficient attention has been given to the effect of the removal of these hydrocarbons—very small in quantity, but at very low vapour tension—which are the most likely ones to condense, and will condense. The greasy condition of the gas is not due to benzene and toluene at all, but to the hydrocarbons that are now removed with them. This means that a substitute has to be used. One means is to evaporate in the gas a paraffin, or something else that will answer the same purpose, in which case, when the gas is cooled, it comes down as fog, and you secure in this way very small globules, in the same manner as by mechanical means. There is no difference between the globules produced by condensing the paraffin and making them by mechanical means with the spray. The smaller globules go forward, and the bigger ones drop down in either case; but if you have very long distances of mains for these particles to travel, you are very likely to lose them, and putting them in on the spot has obvious advantages. A lubricant in the form of a gas would be quite useless, because it would remain a gas, and go through the meters.

I am very much interested in Mr. Tapley's paper. It brought home to my mind the great use there is in technical research applied to questions of this kind. One would not think the immediate outcome of this investigation would be a practical method of dealing with the difficulty. It is not always that researches can lead to practical and useful results. But it shows how very well worth while it is to intelligently examine these difficulties, because a solution may be found; and that is the only way in which you can expect to find a solution. There is one question I should like to mention, in which I am interested, and that is station-meters. It may seem that I am trying to specialize a little too much; but the base-line on which we are drawing these conclusions is the registration of station-meters. In a station-meter the measurement is determined by the position of the water-line, the displacement of the different chambers, and the temperature in a chamber when it is sealed. Of the various methods of correcting gas in a station-meter, a very general one is to take the average temperature at the inlet of the meter and the outlet, and assume that as the temperature inside the drum. I will take a case in which the gas is going into the station-meter at 70° Fahr. The water is 58°; and the outlet of the meter is 60°. The average of these two temperatures is 65°. Now, this is an inference. As a matter of fact, you guess what the temperature is inside the drum; you cannot get inside the drum to see what it is. Some people take the temperature of the water. In that case, you would be obviously wrong. The position of the thermometer on the inlet of the station-meter is generally on the bend of the meter, as near as you can get it. I suggest we might take the temperature of the gases from the station-meter from the chambers at the moment of their discharge, not at the outlet of the meter. When the gas is being discharged, it is in contact with water all the time, and the temperature is varying. The error due to this may be in the nature of 1½ to 1¾ p.ct. I do think that an accurate method of measuring gas from station-meters should be arrived at; and I am quite satisfied that sufficient care in taking observations both of pressure and temperature in station-meters is not always taken.

The PRESIDENT: All this is preliminary; and we are very pleased to have suggestions made. They will all be taken into careful consideration; and you will hear more on the subject from the investigators.

Mr. Taplay, in reply.

Mr. TAPLAY: With regard to Mr. Cockey's remark, it was carbon bisulphide acting with ammonia, not cyanogen. We do not have cyanogen in our case. It is hydrocyanic acid to begin with, and is washed out by special means on the works. The black deposit referred to as iron sulphide, I believe, has been dealt with previously by Dr. Lessing; and I quite agree with him in some things he has said on the point. I do not say there would be any objection to spraying meters in bulk; and there can also be no objection to spraying before sending out either new or after repairing them. Mr. Robinson spoke of the hardness or softness of water for absorbing ammonia. In our case it is not a question of the hardness or softness; but the high ammonia was due to war conditions. We were pressed by the Government to provide more and more benzol, and the amount of benzol taken out increased; and consequently we had to rob the ammonia washers to put oil in for oil-washing. These conditions are now improved, because we have been able to add some new plant to the ammonia washers. With reference to what Dr. Lessing has said, I am aware that he has proved that leathers are dissolved by corrosive liquids. In fact, I believe he mentioned it in the other report of the Life of Gas-Meters Committee. In connection with the interaction of carbon bisulphide with ammonia, he referred to the volume of carbon bisulphide and ammonia not being stated in the report. I did not mention the volume of ammonia. It is true I stated the other, and said it was 0·03 p.ct. Such small volumes cannot account for the unaccounted-for gas. As to the oil gas, the oil in this form is not in anything like the quantity that would be put in by spraying. You would have to use a tremendous amount of oil for carburetting before you arrived at that point. In our works, we have found many olefines removed with the heavy oil for the extraction of benzol. It is not only benzol that is taken out, but a lot of other tarry bodies as well.

I should like to go back to the question of the volume of carbon bisulphide and ammonia as affecting the unaccounted-for gas. The real point, as it appears to me, is that the corrosive liquids dissolve and perforate the floor of the valve-chamber; and the gas so passed would not register. This has been the case; so it is a question of the gas getting through the perforations. In regard to the sheets of tinned iron, the edges were not tinned. I do not think it was necessary to do so, the surfaces of the sheets were perforated. Free sulphur is obtained in the way that Dr. Lessing has suggested; but in the meters that I examined recently, the presence of sulphur was not due to purification oxide, because I took special care to ascertain whether the iron oxide in the chambers was accompanied by disintegrated peat. I did not find it; and it is always present in bog oxide. I am entirely in accord with Mr. Lacey, and am very much obliged to him for what he has said.

Mr. Parkinson.

Mr. PARKINSON: There are only two points I wish to refer to. One is in regard to the dressing of the leather of the meter. I believe meter-makers have used almond oil; and when they could not get it, during the war, they have used as a substitute beech kernel oil. But it is customary to mix blacklead or graphite with it. A meter-maker who has gone most thoroughly into the method of dressing has laid stress on the superiority of heavy mineral oil; and Mr. Lamb, in his report, even mentioned vaseline, which is

like heavy mineral oil. The other matter is as to the temperature of station-meters, which Mr. Lacey referred to in so interesting a way. Some take the temperature at the outlet of the meter, and some at the inlet; while probably some take the mean between the two. You have got to look on the drum of the station-meter as a rotary gasholder. It fills, and there is a point when it is filled and closed; and any changes of temperature or pressure that take place after it is once filled and closed do not affect the registration. Therefore, in taking the mean between the inlet and the outlet temperatures, I should rather incline to come a little nearer the inlet than the outlet, because the inlet pressure is always taken as the pressure under which the gas is being measured in the station-meter.

A Vote of Thanks.

The PRESIDENT: I am sure it would be your pleasure to thank these gentlemen who have laboured so assiduously in our interests. All the points brought out will be considered by the Life of Gas-Meters Committee, who have the whole subject in hand, and are giving attention to every detail. Will someone propose that they be heartily thanked for the great services they have rendered to the Institution, the industry, and the Committee who are dealing with the subject, by their work and communications?

Mr. THOMAS HARDIE (Newcastle-on-Tyne): I shall have much pleasure in proposing that.

Mr. LACEY: I will second it, because I have some experience, and know that the papers, though they are very interesting, do not give one perhaps a fair measure of the amount of work that has been put into them. They are a very valuable addition to our literature. They are facts that are given us—some very valuable data, the securing of which has involved very considerable time. We are all quite agreed that we should thank the authors very sincerely for the work they have done.

The PRESIDENT: And especially as we are going to ask for more work from them. [Applause.]

CHEMICAL ENGINEERING IN MODERN GAS-WORKS.

By WILLIAM A. TWINE, A.M.I.Mech.E., F.C.I., Chemical Superintendent of the Birmingham Gas Department.

[A Paper read before the Midland Association of Gas Engineers and Managers, Thursday, Oct. 31.]

When Lord Moulton, the Immediate Past President of the Institution of Gas Engineers, addressed us last June, we were all impressed by his forceful language. He reminded us of the imagination and daring of the pioneers in the gas industry. They were "innovators rather than inventors;" and I venture to say there yet remains much to be done by innovators in the gas industry of the future.

Most modern developments in gas engineering have been very largely pioneered by the scientists—especially the chemist and the physicist. I believe the successful gas engineers in the future will be those who have made a study of, and have had experience in, chemical engineering; for it will be they whose functions it will be to design and erect plant and apparatus required for the carrying out of chemical processes in gas-works. The engineer will be compelled to recognize that the bye-products are of primary importance, instead of the secondary position to which many engineers give them place. We cannot fail to have noticed the number of patents which have been applied for in connection with the chemistry and physics of gas manufacture; but of all the number, very few prove to be successful when put into practice, largely because the scientist was not an engineer or the engineer did not happen to be a chemist. It is the combination which is undoubtedly required.

Among many schemes of a chemical nature to which men have devoted much time and attention, we may mention:

1. Purification of gas by means of ammonia.
2. Increased quantity of nitrogen compounds either in the form of ammonia or cyanogen compounds.
3. Recovery of cyanogen compounds from coal gas and residuals.
4. Manufacture of ammonium chloride.

There are several others, all of which depend for their success on chemical engineering rather than upon either pure science or engineering.

AMMONIA PURIFICATION.

Taking the first item—namely, ammonia purification of coal gas. Several attempts have been made to carry out into practice what, in theory, is really a very simple chemical reaction. Excellent work has been done by clever men, but without complete success, owing very largely to lack of experience in chemical engineering, with the result that large quantities of ammonia were lost and their schemes abandoned. In Birmingham, Dr. W. B. Davidson, Mr. E. W. Smith, D.Sc., and myself had been most successful in our large-scale experiments, and but for the war, we should have been far advanced by this time.

The object in ammonia purification is in making use of the ammonia distilled from the coal to absorb the impurities, carbonic acid and sulphuretted hydrogen. We all know that at least four prominent men have tried to adopt this method of purification; but owing to loss of ammonia, Claus, Hills, Holgate, and Young, all failed because they lacked experience in the design of plant suitable for the work.

It must be understood that to successfully remove the impurities from the gas, at least four to six times the quantity of ammonia made per ton of coal is required, if all traces of CO_2 and H_2S are to be removed. The whole of this ammonia when it is saturated with H_2S and CO_2 must be so treated that both the gases shall be eliminated in a single vessel, and the resulting liquor used in the washing process; or it may be distilled, and only the pure ammonia gas used for absorbing further quantities of H_2S and CO_2. The major portion of the heat required for desulphurizing and decarbonating the liquor is obtained from waste heat of the retort-house—thus materially reducing the cost of working the process. The excess ammonia is bye-passed, and made use of in manufacturing sulphate of ammonia, liquid ammonia, anhydrous ammonia, or salts of ammonia, as markets demand.

I was invited by Lord Moulton in June, 1916, to suggest to the High Explosives Department a method for obtaining pure ammonia from coke-oven liquors and ammoniacal gas liquor. Up to that time it had not been possible for them to separate the H_2S and CO_2, and in the same operation distil off the ammonia gas to yield pure liquid ammonia of 25 to 30 p.ct. free from CO_2 and H_2S. I am pleased to say, however, that very shortly afterwards I suggested a scheme which resulted in plant being designed capable of completely eliminating the impurities and at the same time yielding 30 p.ct. solution of ammonia.

A similar plant is required in gas-works for the purification of gas by means of ammonia. After having had many years' experience in the distillation of various kinds of ammonia liquors in quantities varying between 120,000 and 150,000 gallons per day, I have no hesitation in saying that the losses of process working should not exceed 1 p.ct., providing special care be exercised in plant joints and fittings. This loss, however, must be multiplied by six, seeing that we require six times the amount of ammonia distilled from the coal. The science of distillation is fairly well known, yet much research is necessary before it can be claimed to be perfect. For many years past distillers of ammonia and other volatile compounds have been content to follow one another, each making some alteration—first this and then that, enlarging this portion, and making smaller that, improving the gas-ways, or making easier cleaning operations, always however the column or chamber still, which at best is an eliminator and absorber alternately. The question of the distillation of ammonia as practised is faulty. It is an expensive operation, because of the amount of steam necessary to drive the ammonia gas from the vessel. Research work is now being carried out, which will materially lessen the cost of distillation, and on some future occasion I look forward to giving the results of these new methods.

Theoretically, we need apparatus which will give up H_2S and CO_2 in one section and yield ammonia in another, which ammonia gas (when once freed) ought never to be allowed to combine again in the apparatus. During these past four years we as a nation have travelled very far along "Progress Road." We have crowded into this short period more applied science than in any quarter of a century previously. The mind of the British chemical engineer has proved clear; and as a result he has shown the world that it is not necessary to look to Germany for all the results in the gas industry or chemical trade. And while in the past Englishmen have proved to be pioneers, frequently we have had to admit that the innovator was a German. Let us see to it that we Anglo-Saxons are in the future so educated that we and our brothers may stand out alone both as pioneers and innovators, ready to propound a theory and carry out into practice such schemes that not only we, but the world, shall know of our greatness.

DEALING WITH THE EVOLVED GASES.

We now come to the operation of dealing with the gases evolved from the eliminating vessel—viz., H_2S and CO_2. These gases may be dealt with in the ordinary Claus kiln in the production of sulphur, or better still they may be burnt to sulphur dioxide, and converted into sulphuric acid in a plant which occupies less than one-sixth the area of a sulphuric acid chamber process—I mean the tower system, one of which has been patented by my former chief, Mr. Wilfrid Wyld, one of our leading chemical engineers, and one whose plants have given great satisfaction to the War Office. The foul gases may be burned in specially constructed ovens, or passed into the ordinary oxide or pyrites burners or flues, after they have been freed from such impurities as pyridine bases, tar, tar oils, and very slight traces of ammonia. Owing to the constant composition of these gases, it is possible to work the acid plant to give an efficiency of 98 p.ct. with a nitre consumption of 1 to 3 p.ct.—being below that of the average chamber process. Another great feature of the plant is that, if it is desired to work only six days per week, no trouble whatever is experienced either in shutting down or starting-up.

TOWER SYSTEMS.

The tower system is divided into two operations; the reduction of the nitrous acid taking place principally in the first half, and oxidization of these compounds and re-absorption in the latter portion.

The circulation of the acids is carried out in the following manner: The acid leaving the first towers is transferred to the later towers and *vice versâ*. Cooling the acids that leave the various towers previous to recirculating them, will allow of full

control of temperature throughout the process, without the use of extraneous cooling. Moreover the whole of the internal packing media is irrigated by the temperature controlled fluid; and the towers do not depend upon the cooling at their circumference alone. Neither steam nor water sprays are needed; the dilution of the acid being effected by a stream of cold water entering the various parts of the circulation system. Stronger acid is producible by the tower system than is usual in chamber systems.

The whole of the columns being of one height, it is very easy to arrange for them to be enclosed under one roof of medium size, and of simple construction, although it is not fully essential to do so. The area occupied by this type of plant is one-sixth that of a chamber set of similar capacity with one-tenth the cubical capacity. By the method of arranging the packing medium, the lining is carried to the top of the columns—thus fully protecting the lead from all corrosion. The filling media consist of vertically placed planes of glass, each piece being supported independently. The amount of exposed contact surface per cubic foot, as well as the free gas space obtained, are the greatest of all known "packers." There is never any need to repack the columns, as the glass is indestructible; and repairs or renewal of the lead may be easily accomplished while the plant is at work.

Comparing the cost of a tower unit with the chamber plant, the former is found to be higher; but when wear and tear, low depreciation, ground space, &c., are taken into consideration, the cost of the tower system described is considerably the cheapest. By the tower system, the loss in SO_3 at the exit is practically *nil*, or one-tenth that of the average exits emanating from ordinary chamber plants. The reduction in loss more than pays for the extra chemical supervision. In case of abnormal working of the plant from any cause, the system is brought round to normal conditions in one-fifth the time of chamber plants.

Gas-Works as Sulphuric Acid Makers.

I venture to predict that in the near future all our large gas-works will produce not only sulphate of ammonia but sulphuric acid as well, in a manner similar to London, Manchester, and Coventry. The acid will be made from their own sulphur, originally found in the coal. In this way much needless expense for acid carriage will be saved. We shall never come down to the old railway rates; and even if they are lowered to a figure between the present rates and those before the war, it is one that can be saved. Our acid, too, would be free from arsenic impurities, and save us no little trouble in the working-up of our salts.

The report of the Select Committee appointed a few months ago to look into the question of the acid trade after the war, shows that they were of opinion that the productive capacity before the war was larger than the output, and that as a result of the erection of large oleum plants and of the extension of existing plants by private manufacturers, a post-war problem has been created. This, of course, is perfectly true were conditions to remain after the war as before; but with so excellent a Chairman of the Sulphate of Ammonia Association, our artificial manure sales must be doubled, and France, Belgium, and Italy, together with our Colonies, will need these manures and we shall get the order, and not Germany. One of the leading American newspapers a few weeks ago said: "The British are the poorest advertisers in the world, yet they can deliver the goods." Now if this is true, then we as a nation must see that our goods are advertised throughout the world. We must never allow Germany to knock us out again, as she has done in the past, whether it be in the product we have to sell, or the man who has to produce it. There are plenty of Englishmen to-day who can tell you more of Germany's scientists and her manufacturers than they can of their own countrymen and their accomplishments. Whatever our faults may have been in the past, and however slow we may have been, surely we must admit that the last four years have proved us to be better than the best German. A few days ago I was talking to a very prominent chemical engineer, who informed me that, after years of experience in competition with German chemical plant manufacturers, he had never yet been placed second to a German, although very often an English firm had divided an order—giving him half and the German firm half. He had never minded this, because sooner or later it was his experience that the other half would surely come his way. It had frequently been his experience, however, to find himself in competition with German firms in Germany, when he had obtained the order for plant designed and manufactured by Englishmen.

Ammonia and its Uses.

I again emphasize the fact that we must advertise; and, as an industry producing ammonia, we must do it in such a manner that no well-equipped establishment will be without its supply of ammonia.

In these days, when labour saving is being so much discussed, ammonia should rank as one of the highest aids in the household for laundry and kitchen work, to say nothing of its benefit as a toilet requisite in the bathroom.

There is a great field for the chemical engineer in gas-works practice, in dealing with ammonium chloride manufacture.

We have recently heard a lot of talk about salty coal and the destruction of fire-brick materials when such coals are carbonized. But seeing that most coals contain varying quantities, the author is of the opinion that we ought to turn our attention to providing ways and means of making money from the hydrochloric acid radicle there contained. When the coal in the retort reaches a temperature of about 1650° Fahr., the salt present becomes decomposed. The liberated alkali combines with the alumino silicates of the retort to form more easily fusible alkali silicates and alkali alumino silicates. which in the first place appear as a glaze on the retorts. This glaze cracks and peels off, thus opening the way to further attack; and so the interior of the firebrick material is gradually destroyed. The acid radicle combines with the ammonia of the gas to form ammonium chloride. The temperature of the gases leaving the retorts is about 1400° Fahr., while in the hydraulic main they drop to about 200° Fahr. On leaving the hydraulic main, the temperature of the gas falls to about 100° to 150° Fahr., so that the greater quantity of ammonium chloride remains behind up to this stage, seeing that it is a fixed ammonium compound. By removing the tar as quickly as possible—by running it through a tar tower, and so saving the possibility of it thickening—and circulating the condensate, we can obtain a concentrated solution of ammonium chloride. This is constantly run off into a purifying tank, where such impurities as thiosulphates, iron, and organic matter are removed—the former by slightly acidifying with a correct mixture of hydrochloric and nitric acids, when the sulphur separates out; while iron which is present as protoxide, and certain organic compounds, are removed by air blowing while the solution is still hot.

When filtered, the liquor is evaporated in a continuous cast-iron evaporator (of the Kestner type), after which it is to be run into crystallizing tanks or, better still, a continuous crystallizing process may be adopted by running the liquor into a long semicircular leaden trough, pitched at a slight angle, and kept rocking by a mechanical appliance fixed at the ends. The crystals thrown out of the mother liquor are drained, washed, and recrystallized. In some cases, owing to organic impurities which interfere with the colour of the crystals, it may be necessary to evaporate to dryness and heat the salt (for a period) to nearly volatilizing point, afterwards dissolving in water, when the carbonaceous matter is rendered insoluble and the filtered liquor is crystallized.

The author is of the opinion that it ought not to be necessary to purchase hydrochloric acid for the manufacture of ammonium chloride, as not only can the value of this acid be saved and a valuable salt be obtained, but by such a scheme the cost of distillation of gas liquor in the manufacture of sulphate of ammonia would be materially reduced, owing to the saving of lime which is necessary in liberating the fixed ammonia—the greater portion being chlorides—from the ammoniacal liquor. The steam required for distillation would also be considerably reduced.

Extraction of Cyanogen Compounds.

Another important chemical process of the gas industry is the extraction of cyanogen compounds. The two commonest methods are those used in the production of sodium ferrocyanide and ammonium sulphocyanide, both of which have been adopted in our Birmingham works.

For ease and simplicity of working, we find the latter method the best. We have two installations giving remarkably good results, with an efficiency of 95 p.ct. One secret of success in cyanogen extraction depends upon the coal gas being free from tar and tar oils; for unless the amount of these impurities is below 4 grains per 100 c.ft., difficulty is experienced, and the efficiency is considerably lowered. Our largest ammonium sulphocyanide plant deals with between 10 and 11 million cubic feet of gas per day. The plant consists of six cast-iron boxes, 25 ft. square by 6 ft. deep, constructed of plates ¾ in. thick. Each box is fitted with two wrought-iron covers 3-16 in. thick, which can be removed and lifted by means of pulley blocks hung from an overhead runway. Wooden grids are supported by cast-iron bearers 9 in. from the bottom of the box; and on these, hard-fused spent oxide (of about 50 p.ct. sulphur) is laid to a depth of 21 in. It is very important, however, that the oxide be graded as follows: First layer, 8 in. of 4 in. material; second layer, 6 in. of 2 in. material; third layer, 4 in. of 1 in. material; fourth layer, 2 in. of ½ in. material; top layer, 1 in. ¼ in. material. In this way the boxes are kept free and open, and do not throw more than 5·10ths back pressure, not even after working for two or three years.

The method of working is as follows: Before the gas is opened into the boxes, the oxide is well wetted with clean filtered water through very fine spray jets. There are eight to each box, four on each opposite side. After this operation, the coal gas is admitted in three streams through mains on the bottom of boxes Nos. 1, 3, and 5, passing up through the oxide and into boxes Nos. 2, 4, and 6 by long openings in the division plates between Nos. 1 and 3, Nos. 2 and 4, and Nos. 5 and 6. The gases travel in a downward course through Nos. 2, 4, and 6 boxes, and join in a common main, leading to the ammonia scrubbers, and thence to the oxide purifiers. Each week the direction of gas travel is reversed; so that the inlet gases during the second week divide into three parallel streams and pass up through Nos. 2, 4, and 6, and down Nos. 1, 3, and 5 boxes. There are valve arrangements allowing of this reversion.

According to the strength of the ammonium sulphocyanide made, so is the amount of water sprayed into the boxes. The time occupied in this spraying will vary between ten and sixty seconds every two hours, according to the cyanogen content in the gas, and also the amount of moisture condensed from the gas, due to atmospheric conditions. We aim at obtaining a solution containing not less than 2 lbs. of ammonium sulphocyanide per gallon. This solution is run off continuously through a 3-in. cast-iron pipe, into store tanks, and analyzed once a day. Providing

the inlet gases are free from tar and oils, the boxes will work for very long periods without recharging the oxide. At present, we have boxes which have been in continual use for nearly three years, and are extracting cyanogen from 10 million cubic feet of gas per day. There should be not less than 1 to 1¼ p.ct. of free oxygen in the gases passing through the boxes; otherwise the sulphur of the oxide is quickly reduced. The temperature of the inlet gases should be controlled to read about 80° to 90° Fahr.—this giving the best results.

CONCLUSION.

If time had permitted, I should have touched upon other processes of a chemical engineering nature, all of which are of great interest and importance; but I trust that my few remarks have interested you sufficiently to realize the relationship between gas and chemical engineering.

POSSIBILITIES FOR THE GAS INDUSTRY.

The Example of Toronto.

The possibilities ahead of the gas industry were considered by Mr. G. W. Allen, of Toronto, in a paper which he read before the last meeting of the Canadian Gas Association (of which he is Secretary and Treasurer); his object being to create enthusiasm among the rank and file engaged in the business, and so stimulate all to greater action.

In quoting from the editorial on a "Vigorous Development Committee for the Gas Industry" which appeared in the "JOURNAL" of June 25 last, Mr. Allen voiced his belief that there should be a Committee brought into existence for the express purpose of vigorously developing the gas industry. The public mind must be disabused of the idea that gas is a back-number, and that electricity will sooner or later supplant it for general purposes. Through public advertisment and by spoken word, the people must be educated to the importance of gas as a public benefactor. Further, every effort should be made to see that no statements appear in the public Press that may be detrimental to the good of the gas industry; and whenever such harmful publicity does appear, gas men should, individually, take on their own shoulders the task of refuting such statements.

Referring to discussions that took place at the first general gathering, last March, of the Canadian Society of Civil Engineers, the author said if any meeting held anywhere could have given gas men more encouragement as to the future of their industry, he would like to hear of it. The trouble with most "gas towns" is that the local people concerned do not make any effort to put their gas plants into first-class condition, considering it only a waste of money to do so. One has, however, only to review the gas situation in a city like Toronto to see what can be done towards developing the industry, and to realize what the future holds in store for those who make an honest endeavour to develop the business. There are many cities where enormous developments have come about since action was taken to encourage the use of gas by the people generally.

As to Toronto, Mr. Allen said the Company started their new business department ten years ago. Though the Company had been in business for sixty years prior to the establishment of this new department, no real progress was made until the present management undertook to educate the consumers in the proper use of gas, by showing them how to get the greatest benefit out of it for the money expended. Many plans were formulated and put into practice to enable the Company to get additional business; and the result has more than justified the time, money, and effort expended. Nine years ago, the Company had about 55,000 consumers; but since then, with the new methods in force, and notwithstanding extreme competition at low rates from electrical men, the consumers have increased to something like 111,000. The output has also gone up by leaps and bounds—from an average ten years ago of 5 to nearly 14 million c.ft. a day. In fact, on many days during last winter, owing to the local shortage of coal, the Company helped out the situation by supplying much additional gas for heating purposes; the output totalling, for all purposes, over 17 million c.ft. of gas per day.

The author believes that almost all coals should be utilized in some form or other in the manufacture of gas; and that the proper solution of the heating and fuel problems within the next few years will be in this direction, if the country is to be saved from a very serious fuel famine. There should be more gas plants scattered about—especially among the larger cities. Wood fuel should only be used by the people in closest proximity to the source of supply; and no coal should be allowed to be shipped to centres where there is abundant wood. Coal—more especially bituminous coal—brought into the country, as well as that mined in the country, should be turned over to gas manufacturing companies or coke-oven plants, and the gas released and sold in such centres and towns where it is not convenient to get a coal or wood supply. The gas could also be distributed in as large an area as possible for domestic, industrial, and other heating purposes at a low price; while the coke would be sold in centres not conveniently situated for a coal, wood, or gas supply. Peat fuel can best be utilized for producing gas, and this gas be sold for heating purposes.

PHYSICS OF THE WELSBACH MANTLE.

The October issue of the "Journal of the Franklin Institute" (Philadelphia) contains the first part of "A Physical Study of the Welsbach Mantle," by Messrs. Herbert E. Ives, E. F. Kingsbury, and E. Karrer—based on a lecture delivered before the Section of Physics and Chemistry of the Institute early this year.

The section that is published occupies no less than 38 printed pages of the Institute's "Transactions;" but it is summarized in the issue last received of the "Proceedings" of the American Illuminating Engineering Society. In this it is pointed out that the investigation described, in so far as it deals with the radiatory characteristics of the incandescent mantle, constitutes chiefly an extension of the work of Rubens on the thoria-ceria mixtures to a large family of such combinations. It exhibits the Welsbach mantle of commerce simply as one of a group of possible combinations of radiatory materials, behaving according to the same general laws, but remarkable among them for the degree to which the characteristics of selective radiation are exhibited.

A more detailed study has been made than any heretofore on the behaviour under various conditions of the absorption bands to which the enhanced visible radiation of the more efficient mantles are due. While no explanation has been found for the occurrence of the visible absorption bands of ceria (a question to be solved only by a more intimate knowledge of the structure), the information learned as to the conditions under which they appear and disappear has made possible a rather complete explanation of some long standing enigmas—notably that of the different behaviour of the mantle in flame and cathode discharge heating.

Another line of investigation has been taken up apparently for the first time in any detail—namely, that of the energy relations holding with flame-heating of radiating materials. As a result of the study, it has been possible to fix with some definiteness the possible attainable efficiencies of gas light production by present methods. These, while low, are still many times now reached.

Gas Undertakings and the Schedule of Protected Occupations.

In reply to a question by Mr. Walter T. Dunn, on behalf of the Council of the Institution of Gas Engineers, as to whether—with reference to the List of Certified Occupations (R. 136 Revised)—the gas industry comes under R. 130 (Revised), as issued in February last, the Commissioner for Trade Exemptions has written him as follows: "Gas undertakings are now entirely covered by the Schedule of Protected Occupations (M.M. 130, Revised). It was, therefore, not deemed necessary to include a reservation for gas-works in the new List of Certified Occupations (R. 136, Revised). I understand that if any gas undertaking is not upon the list of firms dealt with under the M.A.R.O. scheme, the Ministry of Munitions will favourably consider an application from such undertaking for inclusion in the list."

Prof. Bedson on Research and Development.

When delivering his Presidential Address to the Newcastle-on-Tyne Section of the Society of Chemical Industry, Prof. P Phillips Bedson (of the Chair of Chemistry, Armstrong College, Newcastle) was able to point to events which have borne out what he said over thirty years ago, when speaking as Chairman of the section for the first time, as to the benefits conferred by research, pursued for its own sake, upon industry. Viewed from the standpoint of utility, he asked, what more unpromising subject was there than the investigation of the chemistry of rare earths? Yet in his address in 1886 he was able to point to the promise of a great advance in the gas-lighting industry afforded by the facts enshrined in Welsbach's researches, out of which had grown the gas-mantle industry, the dimensions of which might be estimated from the calculation that in 1912 the world's consumption of gas mantles amounted to about 222 millions, and that the price of thoria had been halved in the course of the industry's development. Proceeding to compare the present position of the chemical industry on the Tyne and district with that of 1886, he showed the great progress that has been made in a number of different directions, and in doing so, made some reference to the changes which the last few years have witnessed in the practice of coking—changes which, he said, have been responsible for the rise of a new chemical industry, pregnant with the possibility of further extension, in the midst of industries which owe so much of their development and growth to the inspiration derived from the purely speculative conceptions enshrined in Kekule's theory of the constitution of benzene. Prof. Bedson went on to remark that the advent of the complete scientific utilization of coal in industrial practice has been slow and long-delayed. He recalled the fact that about 1883 considerable interest was aroused locally in the attempt to adapt the recovery of bye-products to the coking of coal in beehive ovens. The interest, however, soon died-down; and for some years methods of coking with the recovery of bye-products received scant attention. To him, it is a matter of personal gratification to observe the revival which has taken place of interest in matters pertaining to the use of coal industrially, and to note, at the same time, that what may be described as the purely scientific aspect of the composition of coal has not been lost sight of.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

A United Association for the Gas Industry.

SIR,—I write to express my full support of the appeal of Mr. Hunt in the current number of the "JOURNAL." The Institution of Gas Engineers, under one name or another, has been in existence long enough to justify its being regarded as more representative and authoritative than any other body. Moreover, the gas industry will depend in the future still more upon technical knowledge and its application than even has been the case in the past; and for this reason the gas engineer is entitled to the fullest share in the settlement of post-war problems affecting the industry which under the new condition of things must arise.

The other organizations named by Mr. Hunt have all, in their several ways, important parts to play in dealing with these problems; and it should not be difficult to devise a system by which their usefulness can be assured, together with that of the parent body.

CHARLES CARPENTER.

South Metropolitan Gas Company, Nov. 11, 1918.

Flame Structure and Flame Contact.

SIR,—In perusing the discussion on the Gas Investigation Committee's report, at the meeting of the Institution of Gas Engineers, published in the "JOURNAL" on the 5th inst., and alluding more particularly to Mr. George Helps's breezy remarks, he challenges reference to others who have prior to his investigations made public allusion to the question of flame structure and flame contact.

In a paper entitled "Illuminating Power and Lighting Efficiency," which I had the honour of contributing to the 1906 meeting of the North British Association of Gas Managers, there are several references to this topic, from which with your permission I will venture to quote.

> During the past six years, I have had occasion to devote very considerable time to investigating the phenomena which go to make up the efficiency of the light emitted by an incandescent burner, and have been directing an investigation into the causes which enable gases of various luminous flame values to render the same illuminating power when burned in the incandescent burner. I have had the opportunity of dealing with many grades of gas, ranging from 12 to upwards of 30 candle power.
>
> It is generally believed that calorific power alone is to be the governing factor in the future; but my investigations warrant my saying that there is at least one other important factor to be taken into account at the present day when determining the value of a gas for lighting purposes. The visible luminosity and calorific power do not alone account for the results obtained when using the gas in incandescent burners, nor can the question of flame temperature alone account for the results. I have therefore no hesitation in saying that flame volume is a factor of even greater importance than calorific power. . . .
>
> Flame volume must be dependent upon the chemical composition of the gas, which I have found can vary very considerably for gases of the same luminous value and approximately of the same calorific power. . . .
>
> If, however, the volume of flame is insufficient to properly envelop every fibre of the mantle, then neither calorific power nor flame temperature can play their part and develop the highest degree of luminosity in the mantle.

So much was I impressed with this factor, that I had constructed an instrument, by means of which we were able to record the flame volume of gases yielded by different coal burned in the same burner.

The paper in question contains a good deal of information bearing upon the Gas Investigation Committee's research, one of which I may perhaps refer to—and that is a table setting forth the candle power of various gases, ranging from 15·57 to 20·32 candles, and in calorific value from 572 to 667 B.Th.U. gross, all of which yielded upwards of 30 candles per foot of gas consumed in an ordinary "C" upright incandescent burner; the gas consumption being carefully adjusted together with the air supply, to develop the highest efficiency with the same mantle used on each occasion, and the consumption varying between 2·89 c.ft. to as much as 3·4 c.ft.

Thirty candles per cubic foot looks high compared with the best results for gas of over 600 B.Th.U. calorific value—see Table 16 of the Research Committee's report. It was, however, a common standard with the Edinburgh gas of 600 to 620 B.Th.U. value over a period of years, and can be substantiated by the record of daily tests of gas sent out.

W. R. HERRING.

4, *Arundel Street, Strand, W.C., Nov.* 7, 1918.

The Gas Research Committee's Report.

SIR,—What surprises me, on reading Prof. Cobb's letter to you of the 30th ult., is that, in the circumstances as related by him, he did not, on receiving my invitation, at once make it clear to me that he was not in a position to entertain it. There is, however, nothing in the letter itself to disprove my suggestion that I feel myself to be in some measure responsible for the labours which the Professor's recent report represents.

CHAS. HUNT.

17, *Victoria Street, S.W., Nov.* 6, 1918.

Benzol and Naphthalene Recovery.

SIR,—I was very interested in reading the paper on the above subject by Mr. Harold E. Copp before the Midland Association of Gas Engineers and Managers, as it is what I have been doing at my Mill Hill works for the past two years, only in another way.

I have been extracting benzol from the wash-oil in my first still by means of an excess of steam, and producing crude benzol averaging about 50 p.ct. up to 120° C. This crude benzol then passes through a smaller still, and is distilled again; the benzol passing away to the storage tank, and the naphthalene and the remaining liquid passing to the settling-tank. The naphthalene settling-out is pressed for the last traces of oil, and the effluent put back into the washer.

This way of working produces crude benzol, testing 80 to 85 p.ct. up to 120° C. The only difference between my way of working and Mr. Copp's is that I am using horizontal stills and ordinary Anglo-American gas-oil against a vertical still and creosote. At the present moment, owing to good fortune, I am having no naphthalene in the gas to extract.

L. TREWBY, General Manager.

North Middlesex Gas Company, Nov. 8, 1918.

The Household Lighting and Fuel Order.

SIR,—As questions in connection with the above are of some interest to you, I enclose herewith a copy of a letter I have addressed to the Coal Controller.

HAROLD CLAPHAM.

Redcar, Nov. 4, 1918.

[ENCLOSURE.]

Coal Controller, Board of Trade and Coal Mines Department, House Fuel and Lighting Branch, London, E.C.

Dear Sir,—With reference to the above Order, I shall be pleased to know if your department would raise any objection to the public making use of their fuel allowances in the following way:

To allow the local gas undertaking to carbonize their allowance, and for them (the consumers) to receive the equivalent, the same to be based on the working results of the local undertaking.

Example.—Assume the local gas-works sells 13,000 c.ft. of gas and 10 cwt. of coke per ton of coal carbonized, the fuel allowance of the consumer is 12 tons. The consumer could then take his allowance as follows:

130,000 c.ft. of gas.
5 tons of coke.
2 tons of coal.

By the reading of the Order, he will probably take it thus:

45,000 c.ft. of gas.
9 tons of coal.

As residuals, such as sulphate of ammonia and tar products, would be available on an extra 7 tons of coal, the advantage to both the fuel economy scheme and the consumer is apparent.

(Signed) HAROLD CLAPHAM.

Redcar, Nov. 4, 1918.

Salaries for Gas Officials.

SIR,—Apropos of the recent correspondence relative to salaries paid to gas officials, the advertisements in your last issue in this connection are instructive.

The Nantwich Urban District Council offer the princely sum of £135 per annum for an assistant accountant and collector; "experience in gas accounts" being a necessary qualification. The Warrington Corporation offer £175, *plus* £26 war bonus—presumably a temporary addition—for a second assistant "able to take entire charge of the works," &c. Without taking into account the enormous increase in cost of living, the above remuneration is paltry. What a premium on honesty *in re* a collectorship at £135 per annum.

As against the above, I see the Abertillery Urban District Council offer £3 3s. 6d. per week, *plus* 12½ p.ct. (possibly the latter is also a war bonus, although not so stated) for a mainlayer. This equals £3 11s. 8d. per week, as against the £2 12s. per week offer of the Nantwich Council. Probably the latter would also require the fortunate individual who secured the job to insure in a guarantee society, unless they consider the salary is high enough to ensure honesty. Evidently manual work pays better than clerical now-a-days.

"NOT AN APPLICANT."

Nov. 8, 1918.

Mr. Glover's Remarks on the Gas Investigation Committee's Report.

SIR,—Your report of my remarks at the recent Institution meeting on the subject of the Gas Investigation Committee's Report contains some inaccuracies. I am reported to have said that "I was up against gas of high calorific intensity," whereas I said I was in favour of this quality; also that "I was up against gas of low illuminating intensity." I am quite sure I never said anything about gas of low illuminating intensity.

At this juncture, when important decisions will soon have to be made as to the quality of gas that can be most economically made and supplied, which will best serve its many domestic and industrial uses, it is essential that accurate records should be kept of the opinions and experience of those who are interesting themselves in this matter. For this reason, I will ask you to be good enough to correct the mistakes made.

THOS. GLOVER.

Gas Office, Bishop Bridge, Norwich. Nov. 9, 1918.

Mr. Isaac Carr and Mr. George Helps.

By inadvertence, half-a-dozen words of importance were omitted from the opening line in the second paragraph of Mr. Isaac Carr's letter to the President of the Manchester District Institution of Gas Engineers, as reproduced on p. 308 of last week's issue of the "JOURNAL." The sentence [the omitted words are printed in italics] should have read: "As I regard Mr. Helps's contention as a physical

impossibility *from the consumer's point of view*, I accepted the challenge in the matter of the hundred guineas; and I now desire to make some observations in relation thereto."

The Discussion on the Investigation Committee's Report.

Two slips which should be corrected were made in reporting on p. 299 of last week's "JOURNAL" the remarks of Mr. J. H. Brearley on the Gas Investigation Committee's report at the recent meeting of the Institution of Gas Engineers. In our report, Mr. Brearley is made to express the opinion that the Committee have proved to a great extent that one B.Th.U. is pretty well as good as another in a "lighting" burner—instead of, as should have been the case, "boiling" burner. The sentence: "It is a firm proof that this is the proper way to begin to investigate these things," should read: "It is a firm proof that it is time we began to investigate these things." Further on Mr. Brearley was made to say it had been shown, both by the results with the "upright" burners and by the discussion, that there was a wide range of efficiency, &c. It should have been "boiling," not "upright."

REGISTER OF PATENTS.

Prepayment Gas-Meters.—No. 119,118.

THORP, FRANKLIN & H. T., of Whitefield, near Manchester.

No. 15,028; Oct. 17, 1917. No. 8320; May 17, 1918.

This combined invention, relating to meters of the rotary or fan type, has for its object to provide means which, while they ensure the passage of a predetermined quantity of gas for the coin inserted in the meter, require that the quantity shall be taken at one time, and that after every stoppage in the withdrawal, it is necessary to reset the prepayment mechanism in its initial position and place a coin therein before a further supply of gas can be withdrawn. This method provides that a gas consumer cannot draw gas paid for by a previous consumer, even though the latter did not utilize the whole of the quantity for which he paid. The meter is particularly adapted for use for the filling of gas receptacles, for gas-furnaces, and for other industrial services.

The invention comprises a main gas-control valve co-operating with the prepayment mechanism, so that the valve may be opened by utilizing the coin inserted in the meter, as a member of the gear train of the prepayment mechanism, while it is closed by the metering mechanism when the predetermined quantity of gas has been passed, and also by the handle by which the valve is opened with the aid of the coin, when the handle is turned backwards to the starting position for the insertion of a further coin. This valve is opened against the action of a spring when the main valve is closed, and it remains open after the main valve has been opened if the rate of gas-flow through the meter exceeds a predetermined minimum, but closes, and remains closed (if the rate is less than the predetermined minimum), until the main valve has been closed by the turning of the coin-operating handle to its initial position for the insertion of a further coin in the meter.

Fig. 1 is a sectional elevation, fig. 2 a sectional elevation on the line I. of fig. 3, and fig. 3 a sectional plan view on the line II. of fig. 1, of one convenient form of the invention.

The gas entering the meter at A impinges upon the rotor B, the spindle of which drives the internal mechanism (including the nut E) carried by the screw F, which is operated by hand through the toothed wheel G and connected train of wheels through a friction clutch; while a bevel wheel K, mounted on a spindle having an enlarged end N with a slot therein (as shown), receives and holds, in conjunction with a similar slotted part O operated by the handle P, the coins inserted into the meter in prepayment for the gas.

The gear wheel Q, fast with the nut E, traverses the forked member R secured upon a spindle carrying at its end the main gas-control valve T. A blade or plate spring V, of similar shape to the spring W (hereinafter referred to), tends to hold the valve T off its seat. The spring causes the rapid closing of the valve when it approaches the closed position.

Beneath the valve T is a second valve disc or plate X, normally drawn towards its seat by the spring W, the arrangement and operation of which is described in Thorp's patent No. 5791 of 1905. When the valve T is closed, the end of its spindle engages the spindle Y of the disc X and holds it off its seat. The disc X is so disposed, and the spring W is so proportioned, that, when the gas is passing through the meter at a rate greater than a predetermined minimum, the disc is held off its seat; the force exerted by the spring W being a maximum when the disc is on its seat, and gradually diminishing as the disc moves from its seat. If, however, the rate of flow is less than the predetermined minimum, the spring draws the disc on to its seat, when it becomes necessary to re-close the valve T by turning the prepayment mechanism before gas can again be obtained from the meter.

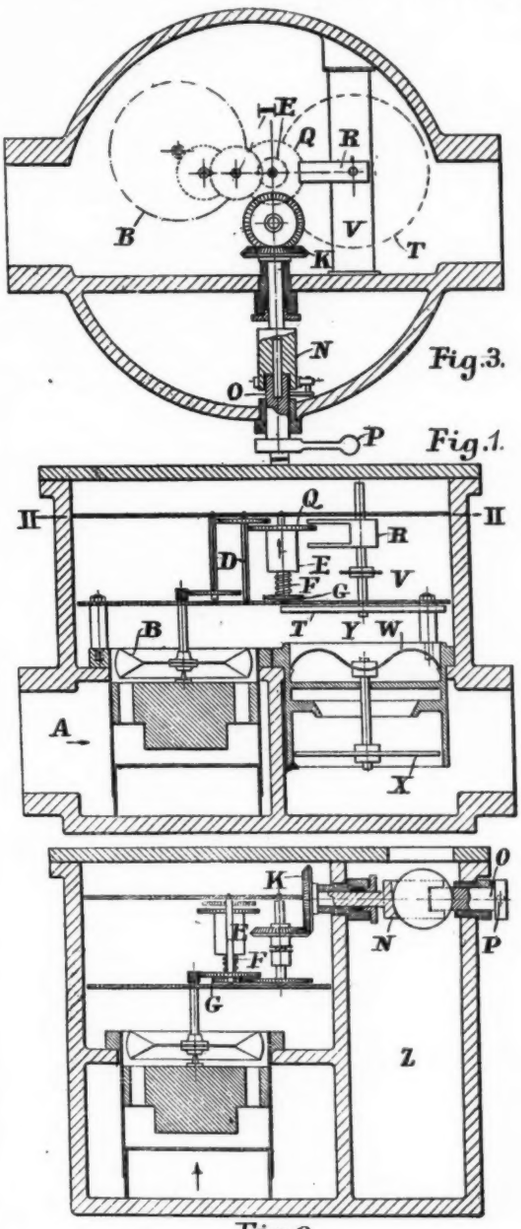
The connection between the elements O and N for one direction of rotation of the handle P is established by the coin inserted in the meter; but in the other direction of movement of P, a pawl on the part O engages the ratchet teeth on the part N, so that the two parts turn together.

The operation of the mechanism is as follows: When a coin is inserted in the slotted elements N and O and the handle P is turned, the screw F causes the fork R to be traversed by the wheel Q and open the valve T. When the latter was shut, the disc X was held off its seat. The consumer, before turning the handle P, connects-up the apparatus to be supplied with gas; and the rate of supply being above the minimum rate at which the rotor B will give an accurate indication of the quantity passing through the meter, the disc X will be held off its seat Z. If the rate of flow should fall, due to the customer's requirements being satisfied, the disc X will close on its seat Z and the gas supply be cut off. Or, if the quantity of gas paid for is used, the rotation of the nut E by the metering mechanism will traverse it along the screw F in a reverse direction and cause the closing of the valve T.

If the gas supply is stopped by the disc X, before a fresh supply of gas can be obtained, the customer must turn the handle P in a direction in which the pawl will turn the part N to bring the parts N and O into a position to receive a fresh coin. The rotation of N in such direction turns the screw F to bring the nut E to its lowest position, and so close the valve T when the disc X is forced off its seat. Thereafter, by the insertion of a coin in the parts N and O, the nut E can be moved to its upper position and the valve T be opened. When the parts N and O are turned through a half-turn after the coin has been inserted, the coin falls out of the slot into the cash receptacle Z.

The distance through which the nut E may be traversed by a coin may be adjusted to vary the quantity of gas supply for each coin inserted. There is a friction drive between the main bevel wheel and spindle which ensures that the parts N and O may be rotated a half-turn independent of the amount of movement imparted to the screw F.

The disc X (which acts as the similar disc of a concurrent patent



Franklin's Prepayment Meter.

No. 117,207) prevents gas being obtained from the meter without the quantity being correctly recorded by the metering mechanism, for no gas can be passed through the meter at less than a predetermined rate, which is the limit of the correct registration by the metering mechanism of the quantity being passed. Further, the disc ensures that no customer can take advantage of the gas paid for, but left unused, by a previous customer.

Regenerative Gas-Furnaces.—No. 119,273.

TOPHAM, W., of Patricroft, near Manchester.

No. 13,652; Sept. 22, 1917.

This invention has reference to regenerative gas-furnaces for reheating ingots, &c., for rolling and hammering; the outstanding feature of it being the arrangement by which the gas conveyed through valve-controlled passages leading to the respective ends of the furnace,

and the air conveyed through valve-controlled passages from the regenerators, are brought together at the correct point and in proximity to one another, "so as to effect rapid combustion."

This is effected by arranging the gas and air ports communicating with the passages at opposite sides of a bridge wall, and perpendicular except at the extreme top where they are deflected, so as to converge, and cause the heated air to co-mingle with the hot gas in a chamber at the other side of the bridge to that of the furnace—the ports, where they converge, being considerably lower than the top of the furnace-bridge.

Gas-Heated Furnaces.—No. 119,553.

YATES, H. JAMES, of Aston, Birmingham, and BRAYSHAW, S. N. & E. R., of Hulme, Manchester.

No. 14,963; Oct. 16, 1917.

This invention—relating to furnaces fired by gas and heated both through the floor of the furnace and by the products of combustion entering the furnace—consists in the particular construction and disposition of a number of transverse passages under the floor of the furnace. The end of each passage projects upwards into the furnace; while a discharge chamber within the opposite wall of the furnace receives the products of combustion through passages above the floor. The gas-burners are set in the front ends of the transverse passages and the air supply pipes in the discharge chamber. In this way, the air is strongly heated before reaching the burner.

Gas-Fires, Electric Radiators, &c.—No. 119,604.

WRAY, C., of Croydon.

No. 2648; Feb. 14, 1918.

This invention has for its object to provide means by which the radiant heat from gas-fires or electric radiators shall be deflected into the room, and the "deleterious effect of currents of cold air passing across the face of, or in relation to, the fire from the sides and bottom of the stove shall be prevented."

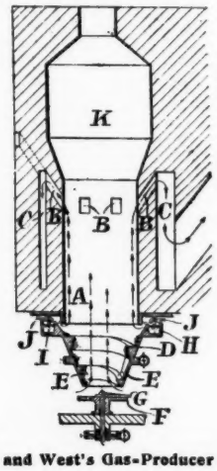
There is combined with the heat reflector—consisting of, for example, a polished sheet of metal, disposed at the lower portion of the apparatus and extending outward from the front of it—substantially horizontal and upwardly extending plates of polished metal, stretching forward, one on each side of the stove, for the purpose of reflecting the heat upwards and outwards into the room, and of excluding currents of cold air passing across the face of the fire from below and from the sides.

Gas-Producers.—No. 119,723.

GLOVER, S., of St. Helens, WEST, J., of Southport, and WEST'S GAS IMPROVEMENT COMPANY, LTD., of Manchester.

No. 15,396; Oct. 23, 1917.

This invention has for its object to provide means for extracting ash from producer furnaces so as to ensure a more uniform rate of gas production throughout the furnace by providing for a uniform thickness of incandescent coke through which the air or gases being acted upon pass, and for the withdrawal of the producer gas at points distributed around the furnace.



Glover and West's Gas-Producer Furnace.

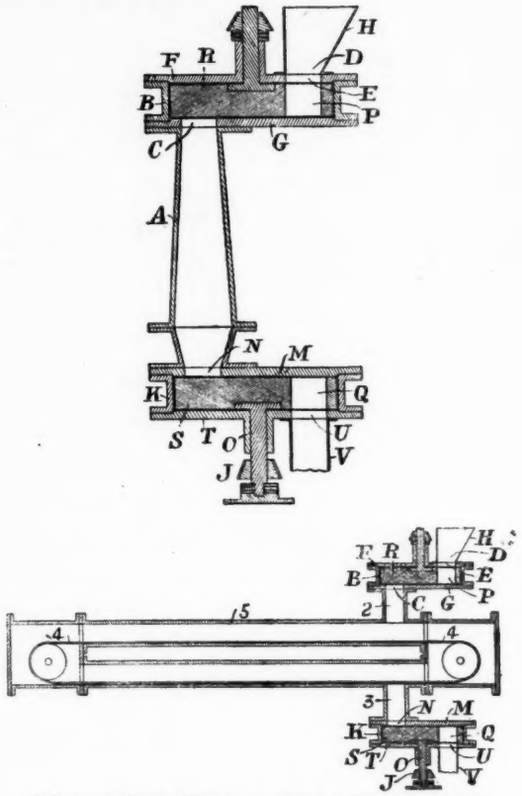
The part A of the furnace to contain the incandescent coke is cylindrical or slightly tapered, and has gas off-take ports B, to provide for the withdrawal of the producer gas evenly all around the incandescent coke. These ports lead to an annular chamber C in the furnace wall, which forms a settling chamber for solid matter, which may be contained in the gas and also serves to equalize the pull on the various gas offtake ports. At the lower end of the furnace chamber is an inverted conical element D (open at the bottom) adapted to be rotated, and having an inwardly projecting spiral rib E of approximately triangular form in cross section, and tapering away at its upper or forward end to a cutting edge. The spiral serves, when the cone is rotated, to extract the ashes from the furnace and discharge them through the open bottom of the cone. Beneath the latter is a circular disc or perforated plate F upon which ash from the cone rests at the angle of repose, so that the self-discharge of the furnace is prevented. Over the plate may be rotated a wiper G, which effects the discharge of the ash from off the plate into a chamber or on to an ash conveyor. The upper end of the inverted cone is provided with an annular liquid trough H, which co-operates with a downwardly projecting ring I from the furnace above, so as to form a water seal. Air is admitted to the furnace through the lower end of the cone, and steam at the upper end of the cone, through pipes J. The upper part K of the furnace, through which coke is admitted, and from which it travels downwards to the incandescent area, may be of larger diameter than the portion in which the producer gas is generated.

Charging and Discharging Retorts.—No. 119,715.

ROBERTON, J., of Dennistoun, Glasgow.

No. 15,284; Oct. 22, 1917.

This invention is specially applicable to retorts for the distillation of cannel coal or bituminous shale, and involves the employment of a rotor for the charging and discharging operations. This rotor is enclosed in a gas-tight casing which, for a charging rotor, is connected gas-tight to the hopper and to the retort, and, in the case of a discharging rotor, to the retort and to a discharge shoot through which the coke is ejected. The rotor may be hung from a central vertical shaft provided with a thrust bearing.



Roberton's Retort Charging and Discharging Apparatus.

The illustration shows how the invention can be applied to a vertical retort, and to a special type of horizontal retort.

In the vertical form, A is the retort; B is a cylindrical casing secured gas-tight to the retort, and with an opening C in its bottom plate G, communicating with the top of the retort; and H is a charging hopper arranged above the casing and with its discharge port D registering with an opening E in the top plate F of the casing.

Within the casing is arranged a rotor R, which is furnished with a plurality of pockets P, which are simply holes extending right through the rotor from top to bottom. The top and bottom faces of the rotor are arranged to work close up to the top and bottom plates F and G of the casing. The holes in the casing, the pockets in the rotor, and the positions of the hopper and retort are so arranged with respect to each other that, during the revolution of the rotor, each pocket in turn comes under the hole E in the top plate of the casing and in another position in its revolution comes above the opening C in the bottom plate.

A rotor S is provided at the bottom of the retort for use in discharging. It is of the same design and proportions as the charging rotor R; being provided with pockets of holes Q, which, in the rotation of the rotor, come in succession opposite the bottom of the retort. The rotor S is enclosed in a casing K similar to the casing B of the charging rotor. It has in its top plate M an opening N registering with the bottom of the retort, and in its bottom plate T an opening U registering with the top of a discharge shoot.

Suitable means must, of course, be provided for the withdrawal of the gases from the retort, but are not included in the present invention and are not shown.

The invention as applied to a horizontal retort of special design is shown; but the several parts in this figure (except the retort) are lettered the same as in the former case. It should, however, be explained that 5 is the retort, 2 its charging duct, and 3 its discharging duct; also that the material being treated is moved from below the charging duct to the left-hand end of the retort by the travelling chain conveyor 4, which also brings it back to over the discharging duct.

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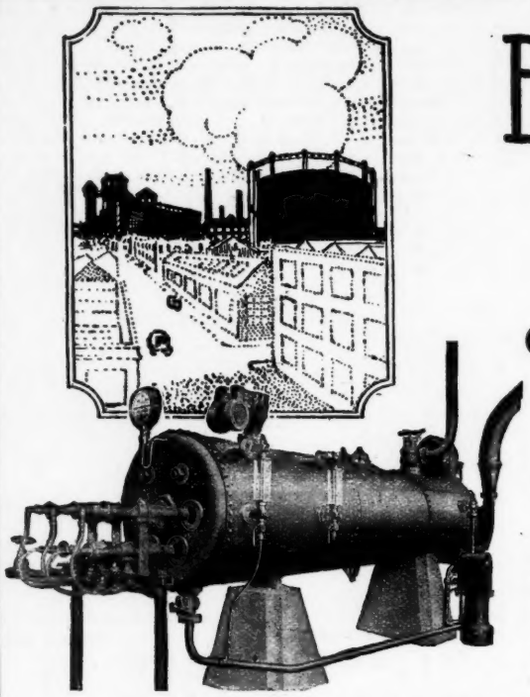

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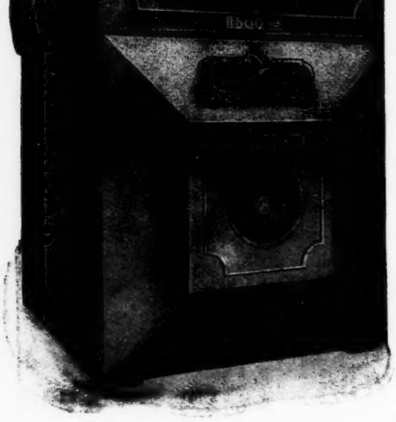

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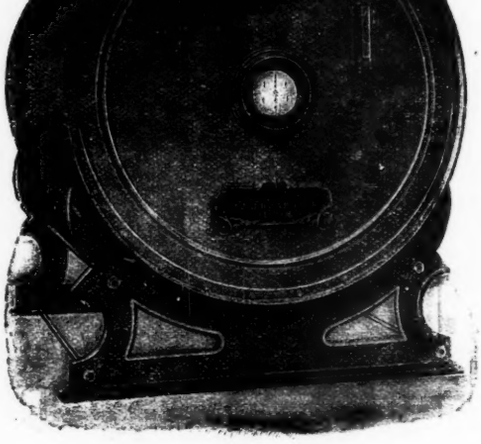

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PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

The Gas Provisional Orders Bill and the Gas and Water Provisional Orders Bill were brought from the Commons, read the first time, and referred to the Examiners.

The South Suburban Gas Bill and the Commercial Gas Bill were reported with amendments; and the Portsea Island Gas Bill, without amendment.

The South Metropolitan Gas Bill was read the third time, with amendments, passed, and returned to the Commons.

The Gas Light and Coke Company's Bill was read a second time, and committed.

The Portsea Island Gas Bill was read the third time, and passed.

The Burghs Gas Supply (Scotland) Amendment Bill was read a second and third times, and passed.

HOUSE OF COMMONS.

Progress of Bills.

The Gas Provisional Orders Bill (Arlesey, Sheffield, and Trowbridge) and the Gas and Water Provisional Orders Bill (including Llandrindod Wells Gas), as amended, were read the third time, and passed.

Petitions against the South Shields Gas Bill have been withdrawn by the Durham County Council, the Hebburn Urban District Council, the South Shields Corporation, the Alkali Manufacturers' Association, the South Shields Rural District Council, the Jarrow Corporation, the North-Eastern Railway Company, the Sunderland Gas Company, and the Trustees and Managers of St. Peter's Church Schools, Jarrow. The Bill is now unopposed.

Early Closing and Light and Coal Saving in Ireland.

Brigadier-General M'CALMONT asked the Chief Secretary for Ireland whether definite days of the week were mentioned in the recent Early Closing Order regardless of the market, fair, and early closing days arranged in different towns in agricultural districts; whether he had received representations on this subject; and whether, without allowing any increased consumption of fuel or light, the Order would be modified.

Mr. SAMUELS, who replied, said that representations in the sense indicated in the question had been received, and were under consideration.

Mr. F. MEEHAN asked whether the Light and Coal Saving Restrictions Order recently applied to Ireland, while imposing penalties on the licensed traders and practically ruining the trade of those of them who carried on combined businesses, afforded no saving of light or coal; and whether the Order would be modified so as to enable traders to do business on market and fair days—the only days on which business was done in rural towns—or fix a uniform one-time closing hour at (say) 7 o'clock p.m. for all traders.

Mr. SHORTT, in the course of his reply, said that an Amending Order was in preparation.

Lighting Restrictions.

Captain BARNETT asked the Home Secretary whether, in view of the marked reduction in street lighting, he would consider the desirability of relaxing the present regulations for the shading of lights in the windows of shops and private houses, especially during those hours of the evening in which the streets were crowded by people returning to their homes.

Sir G. CAVE replied that he was informed by the Military Authorities that it was not desirable to relax the requirements as to the shading of lights in shops and houses at present; but where the police found that more light was required for safety, the necessary steps would be taken to improve the street lighting. He pointed out that, apart from air-raid precautions, the use of lights in shop windows was prohibited on grounds of economy by an Order of the Board of Trade.

Public Lighting and Wastage.

Sir W. BEALE asked the President of the Board of Trade whether his attention had been called to the waste of energy available for lighting or heating caused by the use for street lighting in some parts of London—notably in St. James's Street and Piccadilly and in the Euston district—of arc lamps of high candle-power masked by metal covers or shields which only allowed a small fraction of the candle-power to reach the roadway; whether this waste of power could be greatly mitigated by the use of Osram or other incandescent lamps as in some parts of Oxford Street; and whether he possessed, and would exercise, powers to investigate the subject and put a stop to the waste where it occurred.

Sir A. STANLEY replied that his attention had not been drawn to the particular instance referred to. He had, however, been impressed with the desirability of securing that there should be no avoidable waste in the consumption of gas and electricity for public lighting; and considerable economies had already been effected in this respect. He promised to have the matter looked into.

Shrewsbury Gas-Works Coal Supplies.

Mr. BUTLER LLOYD asked the President of the Board of Trade whether he was aware that the Shrewsbury Gas Company had less than a week's supply of coal in hand and were losing stock; if he was aware that many Government offices, barracks, hospitals, railways, and public institutions depended on the Company for light and heat; if he was aware that a great part of the coal allocated to them came from North Staffordshire from the Minnie Pit, which had been put out of action by an explosion months ago, and had not resumed work; if he was aware that the Company had been refused coal from Ruabon, 27 miles away, and were obliged to fetch it from North-East Durham, 200 miles away; if he would take immediate steps to ensure that the Company had at least one month's supply—namely, 2200 tons—in stock, considering the importance of the district served; and, in the interest of transport, if he would arrange that coal be supplied from some of the many coalfields near to Shrewsbury.

Mr. WARDLE, who replied, said the Shrewsbury Gas Company's supplies had been receiving special attention for some weeks past, and their stock had recently been increased by 485 tons. Arrangements had been made to maintain supplies at the present level in order to meet, as far as possible, current consumption without reducing the stock. The Minnie Pit explosion cut off coal from several undertakings; and as all coal raised at the collieries in the Ruabon district was consumed at places in North Wales, it became necessary to obtain supplies from Durham—the nearest point having available gas coal.

BRENTFORD GAS BILL.

A Committee of the House of Commons presided over by Mr. MOONEY, having spent two sittings in considering the Bill promoted by the Brentford Gas Company, announced last Thursday that they found the preamble proved. They had decided, however, to reduce from £1,200,000 to £800,000 the amount of "B" consolidated stock which the Company sought power to issue.

Mr. HONORATUS LLOYD, K.C., in opening the case on behalf of the promoters, said the object of the Bill was to put the Company into a position to fulfil their statutory obligations. The Company's formation dated from 1821. Their district had become, from the point of view of gas supply, among the greatest in the country, comparing favourably with the largest Provincial undertakings. The Company's works at Brentford were fully occupied and incapable of extension. They had other works at Southall. In 1914, they were faced with the necessity of making a substantially increased quantity of gas; and they deposited a Bill by which they sought authority to acquire a site for new works at Chiswick. The Bill, so far as it related to the site, was rejected; and in order to meet the growing demands of consumers, the Company had been compelled to strain their existing producing plant almost to the breaking point, and to add a substantial amount of water-gas plant. At Southall, they had considerable room for additional works. But if they could have persuaded Parliament to let them have the Chiswick site, they believed they would have been able to make gas more economically; and this would be to the advantage of the consumers. In view of the great opposition to the Company having the site, however, they had struck out of the Bill the proposal relating to it, as well as the clauses amending the sliding-scale—this subject having been dealt with by general legislation. The Company now asked for power to raise additional capital which would enable them to carry on for a reasonable number of years, and power to erect additional works at Southall. They required capacity to produce an additional 13,500,000 c.ft. of gas daily, of which 3,500,000 c.ft. was needed to bring up the production to the level of the demand on the last day of last year. The total authorized share capital of the Company was £2,327,330, of which £1,991,756 had been issued; and the total authorized loan capital was £671,700, of which £366,300 had been issued. Of the unissued capital of about £651,000, they had already spent £355,000—raised by means of mortgages, the sale of securities, and an overdraft from their bankers. The money could be raised either as "B" consolidated stock or as preference. The "B" ordinary stock had a standard dividend of 3½ p.ct.; the standard price of gas being 3s. 9d. per 1000 c.ft., and the actual price 4s. It was obvious that such stock could only be raised, even with the benefit conferred by the General Act of this year, at a considerable discount. The statutory limit upon the existing preference stock was 5 p.ct.; and the loan stock unissued under the present statutory provision could only bear 5 p.ct., except with the assent of the Board of Trade. The Company had recently tried to raise money under the latter power; and had asked permission to do so at 7 p.ct. The Board of Trade, however, restricted the interest to 6 p.ct.; and the Company had been able to issue only £75,000 at this rate. They were anxious by the Bill to obtain power to raise the required capital—whether "B" stock, preference stock, or loan capital—upon such terms as would enable them to obtain par, or they would not get sufficient money to carry out the required works. They asked that the limit of 5 p.ct. existing upon the preference stock and loan capital might be removed, and the rate be left to the discretion of the Directors. The ordinary and preference stocks were subject to the auction clauses. Clause 12 contained an unusual provision. The Company asked for power to refuse to supply gas to new customers, or to increase the supply of existing customers, during the war and for twelve months after its termination, and for such further period as might, on the application of the Company, be prescribed by the Board of Trade. The Company had already been compelled to refuse to supply gas; and having regard to the growing demand, and the circumstances in which they were placed, they sought this temporary protection from the statutory obligations imposed upon gas companies. In the interests of the present consumers, they asked for this interregnum.

Mr. *A. A. Johnston*, the Engineer and Manager of the Company, giving evidence in support of the Bill, said that by the acquisition of the undertakings of the Staines and Egham Company and the Sunbury Company the Brentford Company's area had been increased from fifty to ninety square miles. The undertaking was the eighth in point of size in the country. About two-thirds of their consumers used slot meters. The sales of gas in 1913 were 3351 million c.ft.; and in 1917 this quantity had been increased by 31 p.ct. It was impossible to extend the works at Brentford, where the coal-gas producing plant was overstrained. As high a proportion as 41 p.ct. of water gas had to be used last year by the Company. This proportion was much too high; and the whole of the future expansion must be provided for by coal-gas plant. About 20 p.ct. of water gas would be the proper proportion to use. At one time last winter the Company's supply was

within about an hour of complete exhaustion; and had the prevailing weather continued, the supply of gas must have been stopped. The fact that shortly before the war the Middlesex County Council obtained power to construct the Great Western Road, and had power to prevent its surface being broken up, would entail an additional cost of £100,000 in respect of the works which the Company would carry out. Additional expenditure in laying mains to the chief centres of population would be involved, owing to the proposed new plant being at Southall instead of Chiswick. About 25 p.ct. of the Company's output of gas was used for industrial purposes, and this use was likely to increase after the war.

Mr. *William Cash* gave detailed evidence in support of the Company's financial proposals; and Mr. *Frank Jones*, Mr. *W. Doig Gibb*, and Mr. *Henry Woodall* were called to support Mr. Johnston's estimates and statements.

No witnesses were called by the petitioners against the Bill; but Counsel addressed the Committee on their behalf.

Mr. FREEMAN, K.C., for the London County Council, pointed out how large was the amount of the capital asked for by the Company in proportion to their past capital expenditure, and urged that, inasmuch as it was impossible to carry out the proposed works during the war, the grant of power to raise so large a sum would remove the Company from the control of Parliament for an unduly long period. He asked the Committee to follow the precedent which had been set in two Gas Acts of the present session, of authorizing the Chairman of the Stock Exchange to fix such a rate of interest upon new capital as would secure the sale of the securities at par, and not to leave the matter to the Directors of the Company.

Mr. VESEY KNOX, K.C., for the Barnes District Council, urged the Committee to reduce the amount of the capital which the Company sought authority to raise. He contended that clause 12 was unnecessary and objectionable, and that the Company was sufficiently protected by present emergency legislation.

Mr. CLODE, K.C., for the Southall District Council, and Mr. JEEVES, who appeared for the Twickenham District Council and the owners of two factories and some dwelling-houses at Southall, raised objections to the proposed diversion of a road adjoining the Great Western Railway.

The COMMITTEE, in addition to reducing the amount of new capital to be authorized, decided to strike out of clause 12 the words which would empower the Board of Trade to relieve the Company of the obligation to extend the supply of gas after the expiration of one year from the date of the termination of the war. They required the promoters to bring up to-day the Bill amended in accordance with their decision, which included a requirement relating to the proposed new road at Southall.

LEGAL INTELLIGENCE.

UNLIGHTED STREET STANDARDS.

Liability for Damage Caused by Collision.

In the King's Bench Division of the High Court of Justice, last week, Mr. Justice Lush and Mr. Justice Bailhache heard an appeal from a Lambeth County Court judgment in an action brought by F. D. Baldock, a taxi-cab proprietor, against the Westminster City Council and the Charing Cross, West End, and City Electricity Company, Ltd., for damage to his cab through a collision near Trafalgar Square with an unlighted refuge in the street. Six questions were left to the Jury; and in answer to these, the Jury said the Westminster City Council were guilty of negligence. The case then stood over for further consideration, when it was contended, on behalf of the defendants, that, notwithstanding the findings of the Jury, the defendants were not liable in law. Ultimately, judgment was entered for the defendants [see "JOURNAL" for March 12 last, p. 507]; and the plaintiff appealed.

The action was brought by the plaintiff against the defendants for alleged negligence in failing to have a street refuge in Cockspur Street properly lighted, in not supplying a proper lamp for the refuge, for failing to place a red lamp or other warning on the refuge, and for alleged negligence in placing on the highway a refuge and standard which were a nuisance through not being properly lighted. During the hearing, the Charing Cross, West End, and City Electricity Company were dismissed from the action by consent. At the end of the plaintiff's case, Mr. Lort Williams, on behalf of the Westminster City Council, submitted there was no case to go to the Jury on the grounds that there was (1) no obligation on the defendants to light the refuge, and (2) no evidence of negligence. The questions which were left to the Jury were as follows: (1) Was the accident due to the inevitable causes in the reduced conditions of street lighting?—No. (2) If nay, was it due to any negligence on the part of the defendants, the Westminster City Council?—Yes. (3) What was the negligent act or omission causing the accident?—Omission to maintain a danger lamp at the refuge. (4) Was the accident due to, or contributed to by, the plaintiff's own negligence?—No. (5) Was the light on the refuge alight at the time of the accident?—No. (6) If it was out, what caused it to go out?—In our opinion there is no conclusive evidence to show the cause. The Westminster City Council are the successors of the St. Martin's Vestry; and the refuge, together with the standard on which there is an electric light, were placed in the position which they now occupied by the Vestry. The refuge had guard posts at certain points, with a standard lamp in the centre. Since August, 1914, owing to the war, a number of Orders had been made by the Home Secretary directing the various councils in London to diminish the normal lighting of the highways and streets. At one period an Order was issued that all street lamps should be extinguished; and at the time of the accident in question all lighting in the streets had been ordered to be considerably diminished. The defendants had great difficulties in complying with these various Orders. The difficulty was occasioned by the automatic arrangements to keep the carbons in the lamps in position. The electric power had to be reduced, with the result that in some instances the carbon stuck, and the light was temporarily extinguished. On March 20, 1917, about eight p.m., George Tattersall, a taxi-cab driver employed by the plaintiff, in driving along Charing Cross and Cockspur Street, drove against the guard post of the refuge, causing damage to the taxi-cab; and it was in respect of this damage that the claim was made. Tattersall stated that the light on the refuge was out. At the hearing on further consideration, Mr. Lort Williams contended that the defendants or their predecessors, the St. Martin's Vestry, had statutory authority under section 108 of the Metropolis Management Act, 1855, to place the refuge in the street, and that there was no obligation imposed upon them either (*a*) to light or (*b*) to give warning by light that it had been placed there. But even if there were, the defendants had fulfilled their obligations and duties by placing a standard on the refuge with a light which might reasonably be expected to keep alight, and if alight would well and sufficiently light the street or give warning that the refuge was there. The Judge held that there was no evidence that the particular lamp had gone out before or on the night of the accident, or that the defendants knew that it had gone out or was likely to go out. It would be reasonable to say that defendants were bound to provide against the contingency that a particular lamp might go out.

Mr. Justice LUSH said that the case raised a question of considerable importance. Section 130 of the Metropolis Management Act, 1855, provided for the lighting of streets by the lighting authority, for the maintenance of a sufficient number of lights, and for the keeping of them lighted during such times as might be necessary or proper. The question what was a reasonable degree of lighting was one for the highway authority; and it would not be competent for a Jury to come to the conclusion that it was not what the authority but what the Jury thought was reasonable. But in this case the defendants had adopted the view that the refuge must be lighted; and they had undertaken to light it, and did light it. The question, therefore, was whether there was any evidence which would justify the Jury in saying that in the circumstances the authority had not taken reasonable care in discharging their duty in lighting the refuge. The Judge held that there was no evidence to justify the Jury in taking this view. He said, however, in effect, that if the particular lamp on the particular refuge had gone out before, then it would have been competent for the Jury to say that the defendants were negligent in not providing a substitute or alternative lighting. It did not seem vital to say whether this lamp had gone out previously. There was sufficient evidence that other lamps had gone out; and the defendants were aware that, owing to the pressure, the lamps had become irregular, and that there was great risk at any moment of the lights ceasing. This being so, it was a question for the Jury whether the lighting was reasonable; and it could not be said that there was no evidence to go to them that it was insufficient and not reasonable. The appeal ought to be allowed.

Mr. Justice BAILHACHE agreed.

MISCELLANEOUS NEWS.

CEARA GAS COMPANY, LIMITED.

Improved Conditions Hoped For.

The Annual General Meeting of the Company was held last Friday, at the London Offices, No. 9, Queen Street Place, E.C.—Mr. F. W. BROTHERS, the Chairman, presiding.

The SECRETARY (Mr. E. Pratt) read the notice convening the meeting, and the Auditor's certificate; and the report and accounts were taken as read.

The CHAIRMAN said he thought the accounts did not call for much comment, excepting that the abnormal conditions caused by the war continued, and had had, and still might have for some time, an adverse influence upon the cost of all materials. Comparisons, therefore, were of little use. Though less coal had been used, the cost per ton was slightly more. Under other items—such as repairs and maintenance—the expenditure showed reduction; no heavy renewals having been incurred during the year. Debenture interest (less tax) was more, in consequence of the issue of second debentures for £7500, which became necessary owing to the large arrears then due from the State of Ceará for the public lighting—now happily much reduced. Exchange was favourable throughout the year; so that the item of loss thereon, from which currency on remittances but seldom escaped, was so trifling that it had been charged against the "Exchange Equalization Account," to which account a considerable sum was some years ago transferred from the balance of revenue for this purpose. Towards the end of May last, the shortage of home gas coal became acute; and since then there had been apparently no available surplus for export. So that sooner or later recourse would again have to be had to the United States of America for supplies. This had occurred at intervals since the restriction of the export of home supplies in 1915. Transport might be difficult for the next few months, owing to the lack of steamers for general cargo purposes by which the very small requirements for the Company were usually conveyed; so that with existing freight rates the cost might not be less. In the meantime, the Engineer in Ceará was investigating the possibilities of the use of local substances, which, if successful, might help to conserve the stock of coal, which was fortunately fairly well maintained. The cost would take some time to ascertain; but it might help them to tide-over a difficulty. Altogether there was reason to be thankful to their Engineer and Manager for being able to work as well as he had in exceptional difficulties; and, though this was still impossible to forecast, there was reason to hope that in a measure similar results might accrue in the current year. Should the war come to an end speedily, there

was almost certain to be an improvement in business affairs in Ceará, which the release of steamers and cargo liners would speedily bring; so that it might not be too sanguine to hope that they were nearer this desideratum than was the case this time last year. They could only trust that an improvement might result to the Company. The amount owing for public lighting was much reduced. In March last, the State of Ceará arranged with their creditors for the settlement of liabilities in expired years (caused by the disastrous drought in 1915) by the issue of apolices or bonds, bearing interest at 8 p.ct. These most of the creditors decided to accept; and, in turn, after some negotiations, the arrears of public lighting for June to December, 1915, were paid, half in apolices and half in cash. This the Company felt able to accept; the revenue of the State having improved sufficiently to permit of more punctual current payments. As soon as the Directors prudently could (on Oct. 5 last), the outstanding dividend due to the shareholders for the six months ended June 30, 1914, declared at the annual meeting on Oct. 30 that year—being the last dividend declared—was sent out. This accounted for the somewhat large balance at June 30 of cash and remittances in transit. In regard to the past year, the shareholders might agree with the Directors that it was satisfactory, in the circumstances, to be able to present accounts which showed practically a balance of receipts and expenditure. He moved that the report and accounts be adopted.

Mr. F. A. WALLROTH, J.P., seconded the motion; and it was unanimously carried.

The CHAIRMAN, in moving Mr. Wallroth's re-election as a Director, explained that this gentleman had for some years occupied the chair, and for a very long period had rendered the Company great service as a Director. He had, however, been suffering from ill-health, and felt the chairmanship to be too much of a tax upon him. He had fortunately consented to retain his seat on the Board. In these circumstances the Directors had elected him (Mr. Brothers) as Chairman.

Mr. T. M'MAKING seconded the proposition, which was agreed to.

The Auditor (Mr. W. J. Wright) was also reappointed, on the motion of Mr. R. M. LONG, seconded by Mr. A. H. BRANDT.

The CHAIRMAN moved a vote of thanks to the Engineer and Manager (Mr. W. A. V. Watson) and staff in Ceará, and the Secretary in London. He remarked that in their Engineer they had an exceptionally good man, who had proved himself to be so in very difficult circumstances. Besides being a skilful engineer, he was a man of great resource.

Mr. M'MAKING, who seconded, said the circumstances had been very abnormal; but by making use of local products Mr. Watson had greatly improved the position. Had he depended entirely upon the supply of coal, the balance-sheet would have been of a very different character. He had, however, been able to utilize wood instead. In doing this, of course, there had been innumerable difficulties to overcome in order to continue a satisfactory supply of gas.

The vote was unanimously passed; and a similar compliment to the Chairman and Directors brought the meeting to a close.

SOUTH BRISBANE GAS ACCOUNTS.

An Inquiry into the Company's Financial Affairs.

Following upon an inquiry into the accounts and financial affairs of the South Brisbane Gas Company, Ltd., Mr. W. H. Austin (Chief Audit Inspector) has made a report, which has been printed by order of the Legislative Assembly. He finds that additions made by book entries to the value of the Company's plant, amounting to £114,662, and an issue of £100,000 of debenture stock in 1914 were not justified. The issue of debenture stock could not have been justified in the absence of actual assets available to that increased value, and was apparently intended either as an anticipation of probable legislation, or as the first move in a scheme to obtain greater profits from consumers. His further conclusions are that the balance-sheets presented to the shareholders from 1912 to 1917 have not represented the true position of the Company; that the Directors must be held responsible for the dealings with the accounts, and they have been acting to a great extent on the advice of the Company's Solicitor; and that the Auditors have failed to discharge their duty to the shareholders in respect to the balance-sheets from 1912 to 1917.

The debentures, it is stated in the report, were issued to the shareholders without any payment being made therefor; each shareholder receiving stock to the value of 10s. for every ordinary or preference share held. No mention was in the first place made of the value of the assets, though before the scheme could be consummated it was essential that such value should, by some means, be written-up by £100,000. A month before the issue was made, however, the plant, land, buildings, and undertaking generally were valued by a member of a Sydney firm of gas engineers at £293,096. At subsequent meetings of the Company, this valuation has been the subject of some very severe comments by certain shareholders; but the valuation has always been upheld by the Chairman and the Company's Solicitor. When interviewed by the Auditor, the Valuer stated that he had got out his figures at the request of the Chairman, who had stated that it was only a private matter, and he wanted the figure to be about £290,000. He was not paid the proper fee for a strict valuation. The Auditor's own conclusion is that instead of £293,096 being a proper valuation of the plant, &c., of the Company at Dec. 31, 1914 (when the debentures were issued) the proved valuation was £132,694—this being the total cost, less reasonable depreciation.

Turning to other matters, the Auditor says that, from a perusal of the figures, one must naturally conclude that the cost of producing gas at South Brisbane is excessive, and that there is considerable room for improvement.

Dublin Gas Workers.—The street department workers of the Alliance and Dublin Consumers' Gas Company, who had abandoned work on a question of wages, have resumed pending negotiations.

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SHOWROOMS and BRANCHES: 25, PRINCES STREET, OXFORD CIRCUS, W. 1; 82, Gordon Street, GLASGOW; 18, Severn Street Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY N.S.W.

FUEL AND LIGHTING IN MANCHESTER.

Some notes on the "Rationing of Heat and Light in Manchester" were read by Mr. W. Thomson, the Chairman of the Manchester Section of the Society of Chemical Industry at the opening meeting of the session on Friday evening.

The speaker said that gas, which before the war cost 2s. per 1000 c.ft. in Manchester, and would this month be something like 3s. 4d., was not only dearer, but was almost useless for illuminating purposes unless for burning with an incandescent mantle. From 610 B.Th.U. per c.ft., its heat-producing value had been reduced to 470 B.Th.U.—a reduction of about 23 p.ct. Calculated on the pre-war basis of 2s., the gas as at present distributed to consumers was worth only about 1s. 6½d. per 1000 c.ft. One cubic foot of gas of pre-war quality was sufficient to raise the temperature of 61 gallons of water 1° Fahr., 6 1-10 gallons from 62° to 72°, or about 3 pints from 60° to 212°. A similar amount of present-day gas was capable of raising not more than 2¼ pints of water from atmospheric temperature to boiling-point.

The Fuel and Lighting Order equivalent of gas (15,000 c.ft.) per ton of coal, would yield 7,000,000 units of heat, of which about one-half would be available as radiated heat for heating a room; the remainder being lost. Assuming that an average gas-fire consumed about 20 c.ft. per hour, the amount of gas allowed per ton of coal would permit one gas-fire to be used two hours per day every day in the year, and at a cost of 1½d. per day.

Average house coal, continued the author, yielded about 31,000,000 heat units per ton. According to Mrs. M. W. Fishenden, M.Sc., who has been studying the question of domestic heating by coal-fires for the Manchester Air Pollution Advisory Board, about 27½ p.ct. of the heat from coal burned in an open fireplace is radiated into the room—*i.e.*, about 8,500,000 units of heat per ton. Coke when dry, though it contained less actual heat-producing material, radiated more heat than coal; so that for room heating it might be taken roughly to have the same heat-giving value as coal. The chief advantage under the Order was that 1¼ tons of coke were allowed in lieu of a ton of coal. However, a good deal of the red-hot coke, when withdrawn from the retorts, was extinguished with water; and presumably the coke was sold at the same price as dry coke, though it might possibly contain from 10 to 20 p.ct. of water.

COMMITTEE ON PRODUCTION AWARDS.

The following further award in connection with the wages of gas workers has been issued by the Committee on Production:

HARWICH GAS AND COKE COMPANY (DOVERCOURT).

The parties to the reference were the Harwich Gas and Coke Company and the Workers' Union. The claim submitted on behalf of the Union's members was for the terms and conditions of the award of the Committee on Production to Gas Workers (No. 1068), dated March 27. Representatives of the Union were heard on Oct. 3. The Company were not parties to the above-mentioned award. They have paid their workers the 20s. war advance and the 12½ p.ct. bonus on earnings as from June 22, 1918. The present claim was for retrospective payment as from March 21, 1918. The award of the Committee was that the claim of the men concerned had not been established.

CURRENT SALES OF GAS PRODUCTS.

Tar Products in the Provinces.

Nov. 11.

The average values for gas-works products during the week were: Gas-works coal tar, 30s. 6d. to 35s. 6d. Pitch, East Coast, 44s. to 45s. per ton; West Coast—Manchester 35s. to 40s., Liverpool 35s. to 40s., Clyde 35s. to 40s. nominal. Benzol 90 p.ct., North, 10½d. to 11½d.; 50-90 p.ct., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha in bulk, North, 7¾d. to 8½d. Solvent Naphtha, naked, North, 2s. 11d. to 3s. Heavy naphtha, North, 2s. 11d. to 3s. Creosote, in bulk, North, 4½d. Heavy oils, in bulk, North, 5d. Carbolic acid, 60 p.ct. East and West Coasts, 3s. 6d. naked, nominal. Naphthalene, £25 to £30; salts, £6 to £7, bags included. Anthracene, "A" quality, 4d. to 6d. per minimum 40 p.ct.; "B" quality, 1½d. to 2d.

FROM A MARKET CORRESPONDENT.

Tar Products.

Markets are quiet, and there is no particular change in either conditions or prices. Pitch is firm, although the general position is being very closely watched in all its bearings. Shipments are now being made under licence; but it is not thought at present that there is any intention of restricting exports to our Allies. British possessions and Protectorates are outside the scope of the recent Order—for the present, at any rate. Unfortunately, licencing systems do not work well, and are the cause of considerable delay. The trouble at the moment with regard to pitch seems to be that shippers had engaged steamers before the Order regarding licences was published; and if they cannot obtain licences by the time the boat is ready, they will be in trouble. However, prices are not affected as yet, but are still in an upward direction, especially in Provincial centres. London remains 65s. f.o.b. or thereabouts. In South Wales, there is quite a good demand on account of briquetting works; but prices are rather uncertain. There is no news in either tars or creosote. Toluol and benzol also are without change; but manufacturers are still complaining of the control prices, which are only about half the cost of production. Naphthalene

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"READ THE PRESSURE BY THE POINTER."

No liquid to evaporate and no levels to adjust.

No glasses to break and nothing to clean.

Direct reading, Open scale, Any range (Pressure, Vacuum, or Combination).

Incorrodible, Accurate, for foul or purified gas.

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seems without change, especially as regards refined sorts. There is very little crude on offer now; the fire-lighter demand for the lower qualities being quite good and increasing prices are being paid. Rather more solvent naphtha is being offered for forward delivery, and a slight tendency to accept lower quotations is to be noted, although prices are really unchanged as yet. Various opinions are heard as to the post-war position of this product; but the majority seem to ignore the real factors now (and in the future) governing the value. Heavy naphtha is in demand at late rates. A temporary settlement of carbolic acid prices has been arrived at. For this year, crude 60's are to be sold at 3s. 6d. per gallon, and 3s. 3½d. for 50's. No definite price has been fixed for next year's deliveries. This will, it is understood, depend upon developments in the meantime. There is practically no crystal 40 p.ct. to be had for prompt delivery; but the price is nominally 1s. 10d. to 2s. per lb. Anthracene and aniline oil are very quiet at late rates.

The range of quotations is as follows:

Benzol: 90% London, 1s. 0½d., North 10½d. to 11½d.; 50% North 1s. 4d. to 1s. 5d. naked per gallon.

Carbolic Acid: 60% East and West Coast 3s. per gallon; crystals 40% 1s. 8d. to 2s. per lb.

Crude Tar: London 39s. to 41s.; Midlands 33s. to 35s.; North 32s. to 34s. per ton *ex* works.

Pitch: London 65s. per ton f.o.b. works; East Coast, 38s. to 42s.; West Coast, 41s. 6d. to 43s. f.a.s.; Manchester, 41s. to 42s.; Clyde, 41s.; South Wales, 45s. to 46s. per ton.

Solvent Naphtha: London 3s. 9d. to 4s.; North and Midlands 3s. 3d. to 3s. 6d. per gallon.

Crude Naphtha: Naked 30% 8¼d. to 8½d.; North 6¼d. to 6½d.

Heavy Naphtha: London 3s. to 3s. 6d.; Provincial 3s. 3d.

Naphthalene: Refined £28 per ton nominal; salts 80s., bags included.

Toluol: Naked, London 2s. 4d.; North 2s. 3d.

Creosote: Nominal, London 4¼d.; North 4d. to 4¼d. (Government price, 75s. per ton f.o.b.—equal to 4⅜d. per gallon); heavy oil, 4½d. per gallon in bulk.

Anthracene: "A" quality, 40-45%, 4½d. per unit; "B" quality, 1⅜d. to 2¼d.

Cresylic Acid: 95%, 3s. per gallon; 97-99%, 3s. 3d. to 3s. 6d. per gallon, casks included, *ex* works London and f.o.b. other ports.

Grease Oils 18° Tw. (naked) £6 per ton f.o.r. makers' works.

Sulphate of Ammonia.

The home trade is very steady, and regular deliveries continue to be made; merchants still absorbing stocks for agricultural purposes during the coming season. Exports are on a very small scale; the average price of recent shipments being approximately £26 per ton. This is thought to be unduly low, and is, in fact, very much below what could easily be obtained from neutral buyers were their orders to be accepted. Consequently, in view of the small quantities exported, and the special reasons connected therewith, this price has no significance whatever. In view of the practical cessation of hostilities, interest now centres on future prospects and the possibilities of recovering a portion of our former export trade—all is impossible, unfortunately, by reason of the export restrictions here and the consequent starting of new plants in the countries which were formerly our best customers. Makers realize that they will have to cultivate and extend the home markets much more than they did before the war.

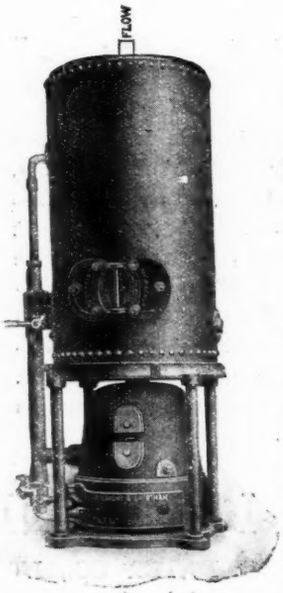
The "Ironmonger" on Publicity Notes.

Says the "Ironmonger:" Some of the circulars which have been issued by the [Coal] Controller's Department of Publicity leave something to be desired, and confirm the rumour that the gentleman responsible for the work is a smart newspaper man—that, and nothing more. Here are two typical bits from a note about what the London banks are doing: "One bank has had its entire gas plant removed in order to save fuel. Hot-water or steam radiators have been installed throughout, enabling open fires to be entirely dispensed with, except in those rooms occupied by all-night workers. Old-fashioned stoves have been replaced by slow-combustion radiators stoked with coke, by which a temperature of between 55° and 60° Fahr. is maintained." Arising out of this, as they say in Parliament, one may ask, What sort of gas plant does a bank require? Why the uncertainty about the radiators? Surely they were steam or water-heating; and how came the bank to get a Priority Certificate to buy boilers, radiators, pipes, and fittings; and where did the labour come from to erect them? Why cannot radiators be employed for warming the rooms used for night shifts? What is a slow-combustion radiator to burn coke? Dr. Johnson, taxed with a mistake in his dictionary, admitted that it was due to sheer ignorance. Only that can account for these notes and some others in a like strain.

Saving Labour and Gas.—The Highways Committee of the Wandsworth Borough Council report that they have considered a letter from the South Metropolitan Gas Company suggesting that the street-lamps in the part of the borough within their district should be extinguished two hours earlier, and lighted one hour later, than the normal times, as is done in some other boroughs, with a view to saving labour and gas. Arrangements were made in 1917 and in the present year for the hours during which the street-lamps are in lighting to be reduced during the period of Summer Time. These proved satisfactory. The above-mentioned suggestion would extend this economy still further; and its adoption in the South Metropolitan Company's district will result in a saving during the remainder of the financial year of about £1321. The Committee therefore recommended that the suggestion of the Company be adopted. The Committee are making inquiries with the view of similar arrangements being made with regard to the lighting in the remainder of the borough.

CONSTANT HOT-WATER SUPPLY

and ECONOMY in GAS-CONSUMPTION.



The "B.T.U." Builders' Set on Low Stand.

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A COMBINED HOT-WATER CIRCULATOR AND STORAGE-TANK FOR DOMESTIC, INSTITUTIONAL, AND COMMERCIAL USES.

GAS-HEATED.

Includes the Patent Thermostat, a valve that automatically controls gas-consumption, and all the other well-known features of the popular "B.T.U." Boiler. Special attention is now called to the latest improvement, known as the

"ECONOMY" VALVE.

The duplicate return connection with this new valve, fitted with indicator plate, gives a dual supply capacity to the storage-tank—(1) For baths, a large supply of hot-water is needed. With the "Economy" Valve full open, 20 gallons of water are heated and circulated. (2) For other purposes, a smaller quantity of hot-water is required. With the "Economy" Valve closed, only 6 gallons of water are heated and kept available. In either case the amount drawn off is immediately replaced in the storage-tank, heated, and kept available for use as often as required. The economy and convenience of this will be obvious.

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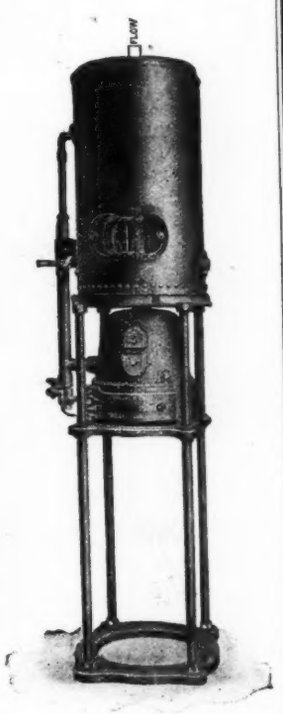


The "B.T.U." Builders' Set on High Stand.

Responsibility for Damage to Public Lamps.

At Wakefield, on Wednesday last, Messrs. Joseph Sykes and Sons, colliery agents, of Slaithwaite, were summoned under the Gas-Works Clauses Act for accidentally damaging a pillar and lamp belonging to the Wakefield Gas Company; £5 damages being claimed. The lamp was knocked down by defendants' motor wagon. The defence took advantage of the section of the Act providing that the only person responsible for the damage was the man who actually did it; and they said the proceedings should have been taken against the man. Mr. Rhodes, defending, denied that he was "taking shelter," and maintained that he was entitled to take advantage of the law. The Mayor said the Bench were there to administer the law, and not, apparently, to administer common sense. Therefore the case must be dismissed.

East Hull Gas Company's Price.—The East Hull Gas Company notify the Hull Corporation of an increase in the price of gas from 2s. 9d. to 3s. 3d. per 1000 c.ft.

Gas-Power from Peat.—In the course of a visit to Portadown, Mr. E. Shortt, the Chief Secretary for Ireland, inspected the weaving factory of Messrs. Hamilton, Robb, & Co., and was greatly interested on finding that the machinery was driven by gas power produced from peat. Mr. Shortt expressed a desire to examine the source of peat supply, and was taken to the bog near the town whence it is drawn.

Assessable Values at Stoke-on-Trent.—Mr. A. Mackay, the Chief Engineer to the County Borough of Stoke-on-Trent Gas Department, has, since his appointment, been giving the matter of assessable values his consideration, both for income-tax and local assessment purposes; and at the last meeting of the Committee he reported that reductions had been arranged in the local assessment of £1200 on the Burslem works, £300 on the Stoke works, and £200 on the Longton works, which represented a total saving to the department of about £1050 annually. He hoped at an early date to be in a position to report the result of his action in connection with the income-tax assessment for each of the works. The Committee expressed their great appreciation of what the Engineer had been able to achieve.

London Gas Coal Economies.—The following note has appeared in the Press: The economy which is being exercised by householders and consumers of light and fuel generally is beginning to tell. Figures compiled by the Coal Controller show a remarkable decrease in the coal consumption of the London gas companies. Greater London is supplied by 34 gas-works. In these during October there was a decrease of 35,000 tons in the quantity of coal carbonized as compared with the corresponding month of last year. In London itself, the Gas Light and Coke Company report a reduction of 5 p.ct. on the month. While the results are regarded as satisfactory, it is felt alike by the Coal Controller and the management of gas-works that only unrelaxed effort towards economy will enable them to carry on over the maximum winter load, which has not yet been reached.

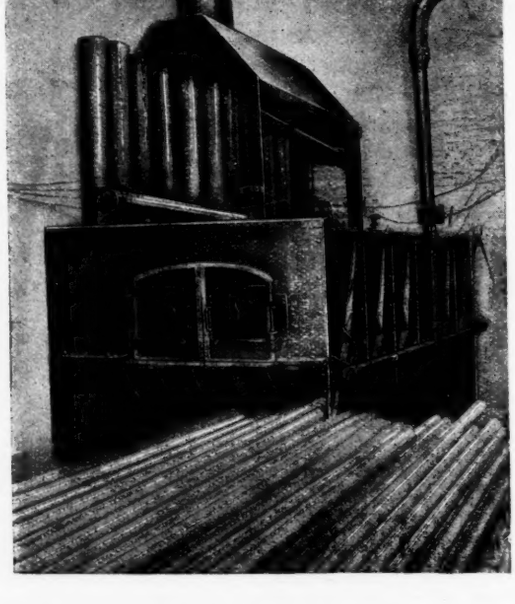
Limavady Gas Undertaking.—At a meeting of the Limavady Urban Council, it was stated that the income from the gas-works for the year ended March last amounted to £811, and that the cost of maintaining the works and paying loan instalments for the same period was £1487. The original amount borrowed for the purchase of the works and their renovation was £3915, of which £2656 has been repaid, leaving a balance of £1259. The works have been closed-down since April last.

Bournemouth Company's Employees on Strike.—Trouble has arisen at Poole with employees of the Bournemouth Gas and Water Company. Some hundreds of men came out on strike on the question of double-time pay for Sundays. The officials tackled the matter with promptitude, being most anxious that no inconvenience should arise to hospitals, munition factories, &c., or to the public generally. With the aid of the clerical staff, they were able to carry on. The difficulty lies in the fact that, while advances were made to meet the increased cost of living, this other question is a pre-war one. It was included in a point in an arbitration placed before the Committee of Production; but the award went against the men—hence the strike.

Quality of Gas at Hull.—Towards the end of last month, the pressure of gas at Hull fell off, and in many houses and business premises illuminated by gas candles were requisitioned. Mr. John Young, the Engineer and Manager of the British Gas Light Company, was waited upon by a deputation of business men, and received an account of the hardships under which the public generally were suffering. A shortage of men through "graditis" and influenza was stated to be at the bottom of the trouble. The former, Mr. Young explained, was the calling up of his Grade 3 men. The matter was also brought to the notice of the Works Committee of the Corporation; and it was stated that, in addition, coal difficulties were having an influence on the gas supply. Influenza had kept many workmen away; and in consequence, the renewal of the retorts could not be expedited. Since then, however, a great improvement has taken place.

Price of Gas at Sowerby Bridge.—At a meeting of the Sowerby Bridge District Council last week, the Chairman (Mr. J. W. Whiteley, J.P.), in intimating the Gas Committee's decision that gas prices must be advanced, said the bringing of the coal to the works by canal when the Government took over the railways in 1914 involved an increase of £1100 per annum in these charges. The closing of a local pit meant that 4000 tons of coal had to be obtained further away, and this added £500 to the cost; while an adverse balance in the earlier part of this year worked out at £1738. Though coal cost advanced by 4s. per ton in June this year, the gas charges were not increased until October. The total increase in the coal bill was £2400. Wages had increased by £3350. cartage by £5900, rates by £1250, and there was another item of £1500, which made a total of £12,000. This necessitated an increase of 1s. 9d. per 1000 c.ft. in gas charges. There would be no surplus gas profits to help in relief of rates this year. He mentioned that permission to extend the street lighting had been obtained, and this would be done as fast as the depletion of staff would allow.

Gas in War Time Industries



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THE RICHMOND

GAS STOVE AND METER CO., LTD.,
Warrington and London.

Tuscan Gas Company.—The report of the Company for the year ended March 31 shows, after providing £2693 for renewals and maintenance of works and services, £3002 for Italian taxes, and £3145 for debenture interest accrued but not paid, a loss of £24,343, which increases the debit balance to be carried forward to £46,442. Last year there was a loss of £51,896 after providing £3427 for renewals and maintenance and £3829 for Italian taxes. This loss of £51,896 was reduced by writing off £29,797 from reserves.

Dublin and Belfast Gas Supplies.—During a discussion on coal shortage at a meeting of the Dublin Corporation, Mr. P. T. Daly alluded to the quality of gas which was being supplied in the city at present, and asked that something should be done to effect an improvement. Alderman O'Beirne joined in the complaint, and said the Corporation should see that consumers obtained a reasonable supply of gas in conformity with the Act of Parliament. No action was taken. At a meeting of the Board of Management of the Ulster Licensed Vintners' Association in Belfast, it was complained that an inferior quality of gas was being supplied in the city; the contention being that the candle-power was not equal to that required by Act of Parliament, and that consumers were placed at a considerable disadvantage. The Secretary was instructed to bring the matter under the notice of the Corporation Gas Department.

Coke Fuel on Long Journeys.—A Midland correspondent, writing in the House Organ of the "Sentinel" Wagon Works, Ltd., of Shrewsbury, remarks: It is sometimes said that coke will not do for long journeys, because the fire requires frequent cleaning; but I have questioned the driver of our 6-ton "Sentinel" Wagon as to the best fuel for long journeys, and he tells me that he always uses coke. If he had the option of good Welsh steam coal, he would have no objection to using it; but otherwise, he much prefers coke over any grade of coal. In going 370 miles, his fire was cleaned out three times; and on one occasion it was really only dropped because he was staying at a place for the night. Otherwise he would probably have done the round trip with two cleanings of the fire only. This was on gas coke. A user of many steam-wagons says that his "Sentinels" regularly run to Bradford, Leeds, and other places—round trips of 100 to 150 miles—using coke only as fuel. This is over some of the most difficult roads and gradients in the country. Wherever possible—and with "Sentinels" this is practically everywhere—coke should, the writer adds, be used as fuel in preference to raw coal, because it is more economical from both national and individual aspects as well as being much cleaner (practically smokeless) in use. Gas companies will note the consistency with which the "Sentinel" people have upheld the advantages of coke for this purpose.

STOCK MARKET REPORT.

LAST week's history of the Great War, with its series of dramatic events following one after another in close succession with almost bewildering rapidity, found the Stock Exchange not insensible to its inspiriting influence. Markets in general, especially those of the choicest securities, responded buoyantly, though here and there might be found an exception debarred by special circumstances. The gilt-edged was a good leader. Home Government issues made great advances; the 5 p.ct. Loan closing at 94½ and Consols at 61¾. Home Rails were in demand, and Argentines made a spurt in view of better dividends and general prospects. The Foreign Market presented several strong points, especially in the issues of the Allied Powers—France, Italy, Russia, and Japan.

Business in the Gas Market took a more animated turn, and there was quite a revival in activity; a noticeable feature being the number of transactions marked in the group of unquoted securities. The tone of the market was very strong. A long list of issues had their quotations revised, and all of them in the upward direction. The most active was Imperial Continental, which made a recovery from its recent set-back, and, after opening at 128, steadily rose to 130½ on Friday. Other issues that advanced in price comprised undertakings in pretty well all parts of the world.

Bargains done for cash during the week were as follows: On Monday, Cape Town 4, Commercial debenture 54, Gas Light ordinary 73½, 73⅝, 73¾, 74, 74¼, 74½, ditto maximum 56, ditto debenture 55, Imperial Continental 128, 128½, 129, 129½, 129¾, 129⅞, 130, Monte Video 9, Primitiva 45s., 46s. 3d., ditto preference 71s. 3d., 71s. 10½d., 75s., San Paulo 7⅝, South Metropolitan 75½, 75¾, 76, 76½, South Suburban debenture 85½. On Tuesday, Commercial 4 p.ct. 62½, Gas Light ordinary 73½, 73½, 73¾, 74, Hastings and St. Leonards 45½, 45⅝, ditto 5 p.ct. 65¼, 65½, Imperial Continental 128, 128½, 129½, 130, Primitiva 46s. 3d., 47s. 6d., ditto preference 71s. 6d., 75s., South Metropolitan 75½, 76, 76½, 76¼, ditto debenture 55½, South Suburban debenture 86, Hawick 5¼, Red Hill 4 p.ct. debenture 66. On Wednesday, Bombay 5 13/16, 5¼, 5½, Brentford "B" 70, Brighton and Hove original 139, Gas Light ordinary 73, 73⅜, 73½, 74, ditto debenture 55½, 55⅝, 56⅛, Imperial Continental 127⅞, 128, 128½, 129½, Primitiva 46s. 3d., 46s. 6d., ditto preference 72s. 6d., 73s. 6d., 73s. 9d., South Metropolitan 76, ditto debenture 56, British debenture (Norwich) 58⅛, 58¾, ditto (Potteries) 50, 50½, ditto (Trowbridge) 58¼, 58¾. On Thursday, Alliance and Dublin 52½, Bombay 5 13/16, Commercial debenture 54, Gas Light ordinary 73½, 73¾, ditto preference 68¼, ditto debenture 56½, Imperial Continental 127, 127½, 128, 128½, 129, ditto debenture 71¼, Monte Video 9½, Primitiva 46s. 3d., ditto preference 72s. 6d., 73s. 9d., 74s. 4½d., 75s., South African 12½, South Metropolitan 75, 75½, 76, ditto debenture 55½, 56. On Friday, Brighton and Hove original 140, 140½, 141, Continental Union 51½, Gas Light ordinary 73½, 73¾, 74, Imperial Continental 128½, 129, 129½, 129½, 130, 130½, 130½, ditto debenture 71, 71½, 72, Primitiva 46s. 3d., 47s., 47s. 3d., ditto preference 73s. 9d., 75s., South Metropolitan 76, 76½.

In the Money Market, rates ruled easy for the most part. The Bank rate is 5 p.ct., as fixed on April 5, 1917.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue £	Shares	When Dividend.	Ante War Dividend & Bonus p.c.	Last Dividend.	NAME.	Closing Prices July 30, 1914	Present Prices	Lowest and Highest Prices of Bargains.
162,049	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.		55—60	
1,551,868	,,	April 8	2½	4⅝%	Alliance & Dublin Ord.	59—64	61—66	52½
974,000	,,	July 10	4	4%	Do. 4 p.c. Deb.	76—79	62—67	..
980,000	5	April 29	7½	8%	Bombay, Ltd.	5⅞—6	5½—6	5 13/16—5½
50,000	10	Feb. 26	16	11%	Bournemouth Gas and Water { 10 p.c.	29—30	21—23	..
988,110	10	,,	7	7%	B ¶ p.c.	15—15½	10—11	..
115,000	10	,,	6	6/-	Pref. 6 p.c.	13½—14	9—9½	..
159,740	—	—	—	4%	4 p.c. Deb.	..	66—68	..
992,045	Stk.	Feb. 26	14	14%	Brentford A Consolid.	261—266	78—81	..
734,920	,,	,,	11	11%	Do. B New	204—209	69—72	70
85,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	77—82	..
231,400	,,	June 11	4	4%	Do. 4 p.c. Deb.	91—93	63—65	..
217,880	,,	Feb. 26	11	8½%	Brighton & Hove Orig.	208—213	137—142	139—141
344,900	,,	,,	8	5½%	Do. A Ord. Stk.	154—159	95—100	..
580,000	20	Mar. 26	13½	22/6	British	44—45	31—32	..
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	64—66	..
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	51—54	..
100,000	10	—	—	—	CapeTown & Dis., Ltd.	1½—2½	3⅞—4½	4
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—6	7½—8½	8
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	60—65	..
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	79—81	..
1,518,280	,,	Feb. 12	5/9/4	36/-	Commercial 4 p.c. Stk.	106—108	62—67	62[2]
850,000	,,	,,	5½	80/-	Do. 3½ p.c. do.	103—105	18—63	..
475,000	,,	June 11	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	52—54	54
800,000	,,	,,	4	—	Continental Union Ltd.	76—79	50—55	51½
300,000	,,	,,	7	—	Do. ¶ p.c. Pref.	115—118	70—75	..
278,400	—	—	—	10½%	Croydon B and C ¶ p.c.	..	140—150	..
—	—	—	—	10%	Do. E.	..	..	..
492,270	Stk.	—	6	5½%	Derby Con. Stk.	128—135	95—100	..
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	80—83	..
1,002,180	10	July 29	10	5/0	European, Ltd.	17½—18	13—14	..
16,296,975	Stk.	Feb. 10	4/17/4	29/4	Gas Light and Coke { 4 p.c. Ord.	98—103	73—75	73—74½
2,600,000	,,	,,	9½	3½%	3½ p.c. max.	76—79	54—56	56
4,062,235	,,	,,	4	4%	4 p.c. Con. Pref.	96—99	67—69	68½
4,674,850	,,	June 11	8	3%	3 p.c. Con. Deb.	72½—74½	75—57	55—56½
190,000	,,	,,	10	10%	10 p.c. Bonds	..	..	..
258,740	,,	Mar. 12	5	2½%	Hastings & St. L. 3½ p.c.	87—89	45—50	45½—45
70,000	10	April 29	11	8%	Hongkong & China, Ltd.	16½—16¾	7—8	..
86,600	—	—	—	9½%	Hornsey ¶ p.c.	..	112—117	..
131,000	Stk.	Mar. 12	7½	6½%	Ilford A and C.	151—154	92—97	..
65,780	,,	,,	6⅜	4⅝%	Do. B.	116—118	70—75	..
65,500	,,	June 26	4	4%	Do. 4 p.c. Deb.	92—94	62—65	..
4,940,000	,,	May 14	9	4½%	Imperial Continental	150—160	127—132	127—130
1,235,000	,,	Feb. 12	8½	8½%	Do. 8½ p.c. Deb. Red.	84—86	71—73	71—72
235,343	,,	Mar. 12	6¾	6½%	Lea Bridge Ord. 5 p.c.	119—121	93—98	..
2,498,995	,,	Feb. 26	10	5%	Liverpool 5 p.c. Ord. { A	146—148	82—84	..
					B			..
806,088	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	71—78	..
75,000	5	June 11	6	8%	Malta & Mediterranean	4½—4¾	3½—3¾	..
250,000	100	April 1	4½	4½%	Met. of Melbourne { 4½ p.c. Deb.	99—101	87—98	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	8½—9½	—9½
1,575,823	Stk.	July 29	4½	3½%	Newcastle&Gatsh'dCon.	99½—99¾	70—70½	..
539,705	,,	June 26	3½	3½%	Do. 3½ p.c. Deb.	82—83	59—61	..
55,940	10	Feb. 26	7/14/0	7%	North Middlesex ¶ p.c.	14—15	9½—10½	..
800,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	103—105	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	4—5	..
60,000	50	Feb. 26	18	9%	Portsea, Island B	128—131	78—83	..
100,000	50	,,	12	8%	Do. C	118—121	73—78	..
63,000	50	,,	10	6%	Do. D	..	..	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	2½—2½	45/—47/6
499,960	5	June 26	5	2/6	Do. 5 p.c. Pref.	4½—5	3½—[illegible]	71/3—75/-
521,600	100	June 2	4	4%	Do. 4 p.c. Deb.	91—93	75—77	..
—	—	—	—	4%	Do. ,, 1911	..	50—55	..
846,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	85—87	55—60	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	7½—8	7⅝
125,000	50	July 1	5	5%	5 p.c. Deb.	47—49	40—42	..
135,000	Stk.	Mar. 12	10	10%	Sheffield A	228—234	170—173	..
209,984	,,	,,	10	10%	Do. B	229—234	170—173	..
528,500	,,	,,	10	10%	Do. C	220—222	168—172	..
90,000	10	May 28	9	6/-	South African	10½—11½	11½—12½	12½
8,609,895	Stk.	Feb. 10	5/4/0	32/-	South Met. 4 p.c. Ord.	111—113	76—77	75½—76½
250,000	,,	July 12	—	5%	Do. Pref.	..	91—98	..
1,895,445	,,	July 10	3	3%	Do. 3 p.c. Deb.	72½—74½	55—57	55½—56
294,890	,,	Feb. 26	8½	6%	South Shields Con. Stk.	167—169	118—119	..
962,795	,,	,,	6	3½%	S'th Suburb'n Ord. 5 p.c.	114—116	75—78	..
60,000	,,	,,	5	5%	Do. 5 p.c. Pref.	110—112	75—78	..
135,000	—	—	—	3½%	Do. West Kent	..	..	..
197,558	Stk.	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116—118	85—87	85½—86
647,740	,,	May 14	5	3%	Southampton Ord.	99—102	68—71	..
120,000	,,	Feb. 12	7½	5½%	Tottenham { A 5 p.c.	135—138	92—97	..
782,275	,,	,,	6	4%	District { B 3½ p.c.	115—117	67—69	..
181,255	,,	June 26	4	4%	4 p.c. Deb.	87—89	61—63	..
183,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	45—50	..
236,476	Stk.	Mar. 12	5	5%	Tynemouth 5 p.c. max.	108½—109½	87—88	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	,,	Feb. 26	8⅞	63/9	Wandsworth A 5 p.c.	151—156	90—95	..
255,886	,,	,,	6⅞	48/9	Do. B 3½ p.c.	129—134	70—75	..
108,075	,,	,,	5/17/8	44/7½	Do. C 3½ p.c.	110—115	70—76	..
363,000	,,	,,	5½	42/6	Wimbledon 5 p.c.	117—123	70—75	71½
98,000	,,	,,	6⅛	48/9	Epsom 5 p.c.	121—126	72—77	..
88,416	,,	June 26	3	3%	3 p.c. Deb. Stk.	66—69	49—52	..

Coal Shortage at Derby.—The serious shortage of coal at Derby is causing considerable anxiety among those responsible for the lighting efficiency of the borough; and both the gas and electricity concerns are experiencing much difficulty in coping with the public demands. The position locally has been aggravated somewhat through the closing of the Derby Kilburn Colliery Company's pits, whose output of coal was large; and, as a reserve in case of emergency, the Town Council have agreed to purchase 2000 tons of fuel wood.

Gas and Meter Testing in Canada.—Statistics of the Inland Revenues of the Dominion of Canada for the fiscal year ended March 31 last show, in a table of coal and water gas companies registered and tests made, the highest, lowest, and average B.Th.U. found. There are in the list 36 companies; but in three cases testing apparatus is not yet installed. Of the other 33, the average in five cases is over 600 B.Th.U.; and in twenty, it is more than 550 B.Th.U. The lowest average is 522, and the highest 643. There were 75,166 meters tested; and of these 1009 were rejected.

Increased Prices at Walsall.—The Walsall Gas Committee report that, in order to meet the increased costs of coal and wages, the price of gas to all consumers in the borough and outlying districts was increased from the September readings of the meters, as follows: For manufacturing and power purposes, 6d. per 1000 c.ft.; for lighting and domestic purposes, 4d.; for slot-meters, 3½d.; for omnibus traction, 6d.; and for traction purposes (other than omnibuses), ¾d. per 100 c.ft., or any portion thereof, between the hours of 8 a.m. and 6 p.m.—beyond these hours, and also on Saturday afternoons and Sundays, an extra 3d. per 100 c.ft. to be charged.

Price and Leakage at Knaresborough.—The Knaresborough Urban Council Gas Committee last week recommended an increase of 1s. per 1000 c.ft. in the price of gas—from 4s. 3d. to 5s. 3d.—but after a protracted discussion, the matter was referred back for further consideration and report to a special meeting. There were criticisms of the management policy; and a proposition by the Chairman of the Council was carried, that an expert should be engaged to visit the works and advise generally. Serious leakage was reported; the Chairman stating that this item accounted for 2,800,000 c.ft. in 1916, 4,800,000 c.ft. in 1917, and 6,220,000 c.ft. in 1918. Last year it was equal to a loss of 20 p.ct. of the output, and this year of 25 p.ct. The attention of the Council was drawn to the fact that the maximum price is limited to 4s. 6d. per 1000 ft. by the Knaresborough Improvement Act.

Wexford Gas-Works Dispute.—In connection with a dispute between the Wexford Gas Company and their employees, and a difference of opinion between the Directors and Mr. Alfred Lyne, the Manager and Secretary, as to the settlement, Mr. Lyne has published a statement in which he says that he acted on principle in refusing to re-start the works on the Directors conceding the men's demands, including an arrangement for three shifts. He was convinced, he observes, that to do so would be to involve the Company in serious difficulties. For one thing, a large increase in working expenses now meant loss, not only to the shareholders, but to the consumers. But, apart from other considerations, the management should, he holds, be supported by the Directors, who made the settlement without ever consulting him. With the responsibility cast upon him, he could not allow the re-start. He had been for 20 years assistant to his late father, who was for over 53 years Manager and Secretary; and he regretted that his long experience should not have been of value in this instance. He has no regret to offer for his attitude, which, he contends, was based on the safety of the works and the interests of the Company as well as the public. Mr. Charles Barry has been acting as Secretary of the Company *pro tem.*

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Nov. 6.]

Nos. 17,518—17,972.

ABRAHAMS, E. GOLDSMID.—"Automobiles using producer gas as fuel." No. 17,646.

ABRAHAMS, E. GOLDSMID.—"Construction of generators for production of gas from solid fuel for automobile engines, &c." No. 17,647.

ACETYLENE EQUIPMENT COMPANY.—"Gas-cylinders." No. 17,657.

AKTIEBOLAGET INGENIÖRSFIRMA F. EGNELL.—"Registering-mechanism for gas-analyzing apparatus." No. 17,912.

AKTIEBOLAGET MJOLKINGSMASKIN OMEGA.—"Apparatus for effecting momentary reversion of direction of flow of gases." No. 17,800.

BRITISH DYES, LTD.—"Process for increasing production and efficiency of contact plants in manufacture of sulphuric acid." No. 17,869.

CLARK, J. G.—"Safety-valve for gas-meters." No. 17,694.

DAVIDSON, W. B.—See British Dyes. No. 17,869.

ELLISON, H.—"Retorts for continuous carbonization of coal, &c." No. 17,782.

ELLISON, P.—"Supply of compressed gas to explosion engines, &c." No. 17,751.

IRMINGER, J.—"Indicating and recording mechanism for gas, &c., meters." No. 17,967.

KIRKE, P. ST. G.—"Burning gaseous fuel." No. 17,918.

LARKIN, F. S.—See Clark. No. 17,694.

LOKMANN, E.—"Valves or cocks." No. 17,594.

LUCAS, E. E.—"Gas-burners or blowpipes for furnace heating, &c." No. 17,781.

PARKER, J. W.—See Abrahams. Nos. 17,646, 17,647.

RAWLINGS, J. S.—"Prepayment gas-meters." No. 17,816.

SOC. ANON. DES APPAREILS J. E. MALIVERT.—"Valves or cocks." No. 17,755.

SPENCE & SONS, P.—"Recovery of sulphur." No. 17,691.

STEPHENSON, A.—See Acetylene. No. 17,657.

TANSLEY, G. E.—"Apparatus for cooling gases." No. 17,821.

TURNER, J.—See British Dyes. No. 17,869.

WILKINSON, J.—See Ellison. No. 17,782.

WOODHOUSE, A. E.—"Valves and cocks." No. 17,928.

WOODHOUSE, W. B.—See Ellison. No. 17,782.

Where Gas-Works Should be Placed.—Speaking at a Chiswick meeting, in connection with the suggested development of the Duke's Meadows by a town-planning scheme, Mr. John Burns declared that if the proposed gas-works scheme had been carried out, it would have been a calamity for Chiswick. Below London Bridge was the proper place for gas-works. If he could have his way, he would not have a single soul living in the Isle of Dogs. He would put a ring of poplar trees round it, and have nothing but gas-works, chemical works, and polish factories in the area.

Objecting to Increased Gas Prices.—The Southwark Borough Council, who have received an intimation from the Gas Light and Coke Company that they are compelled to increase the price of gas supplied to the street-lamps to 4s. 4d. per 1000 c.ft., have decided to inform the Company that, "while they realize that the Company possess statutory powers enabling them to increase the price of gas as they have intimated they propose to do, the Council strongly disapproves of these powers being exercised to an unlimited extent under the abnormal conditions at present prevailing."

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

IN ENGINEERING, CHEMICAL, AND COMMERCIAL DEPARTMENTS (WAR LOSS REPLACEMENTS). South Metropolitan Gas Company.

ASSISTANT ENGINEER AND MANAGER. Macclesfield Gas Department. Applications by Nov. 18.

CONSTRUCTIONAL ENGINEER. No. 6523.

JUNIOR WORKS ASSISTANT. No. 6519.

JUNIOR ASSISTANT CHEMIST. No. 6527.

SECOND ASSISTANT. No. 6525.

DRAUGHTSMAN. No. 6528.

CARBONIZING FOREMAN. Barnet Gas and Water Company.

SLOT METER COLLECTOR. Littlehampton Gas Company.

Appointments, &c., Vacant (*Continued*).

SATURATOR MEN. Sheffield Gas-Works.

STOKER. Merthyr Vale Gas-Works.

STOKERS. Yeovil Gas-Works.

Appointments, &c., Wanted.

ENTIRE MANAGEMENT OF MEDIUM SIZED GAS-WORKS, No. 6526.

Plant, &c., for Sale.

BIGGS-WALL HAND CHARGING MACHINE. Clevedon Gas-Works.

ENGINE AND PUMP. Clevedon Water Company.

HOT WATER CIRCULATORS. Gas Light and Coke Company, Horseferry Road, S.W.1.

IRON SHEETS. Erector, Leeds.

STATION METER. Clayton, Son, and Co., Ltd., Leeds.

Plant, &c., Wanted.

CONDENSERS. No. 6524.

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